



New Hampshire

Environmental Health Data Integration Network (EHDIN) Implementation Plan

*“A Place Where Environmental and Public Health Data
Work in Harmony for the Improvement of Public Health”*

February 2006 – Version 1.1

This document is a cooperative effort of the following agencies:



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Note

Throughout this report, the following designations or acronyms will be used:

NH DHHS – NH Department of Health and Human Services

NH DPHS – NH Division of Public Health Services

NH DES – NH Department of Environmental Services

NH OIT – NH Office of Information Technology

NH EPHT Program – NH Environmental Public Health Tracking Program

NH EHDIN or the Network – NH Environment and Health Data Integration Network

National SND – Standards and Network Development workgroup

Network Plan or the Plan – NH EHDIN Implementation Plan

National NIP – National Network Implementation Plan

National EPHTN or National Network – National Environmental Public Health Tracking Network

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1.0 Introduction to the New Hampshire Environmental Health Data Integration Network (EHDIN)

In this report, we present a plan for the creation of a NH Environmental Health Data Integration Network (EHDIN) that will provide a powerful tool for understanding the complex issues of health and environmental associations in New Hampshire. The Network will provide access to linked datasets within a system that is light on staff labor, supported by efficient information systems, and built from existing technology. The Network is designed to solve the problem of isolated data, often stored in restricted silos, and rarely able to be compared or understood except in limited research studies. With NH EHDIN, we plan to create a place where health and environmental data can work in harmony for the benefit of many agencies and stakeholders.

The Network is a partnership among three cooperative agencies: the State public health agency (NH DHHS), the State environmental agency (NH DES), and the Centers for Disease Control and Prevention (CDC) in Atlanta. New Hampshire has become part of a broader group of 24 state and city partners dedicated to building a national Environmental Public Health Tracking (EPHT). The system will provide automated environmental health data at the state, regional and national level, in a format desired by government, business, and professional institutions so they may better handle the growing information on issues such as asthma, cancer, and acute or chronic poisonings. NH EHDIN intends to deliver environmental and health data to our stakeholders in a rapid, high quality format that will allow them to more efficiently address problems affecting our citizens.

The NH EHDIN Implementation Plan, as described in the following chapters, reflects the vision we have for our state Network, as well as the goals, objectives, implementation, challenges and approaches we envision. The Plan is meant to clarify how the Network will evolve, deliver information, and meet the needs of stakeholders in a collaborative way. Included in the following Introduction Section is a description of the Network purpose, our target audience, our approach to planning, and the elements of the plan.

1.1 Purpose and Objectives of the NH EHDIN Implementation Plan

The purpose of the NH EHDIN Implementation Plan is to propose options for the development of the Network and guide the development of functions, content, technology and coordination. The Network plan has the following objectives:

- Review the background and context for Network implementation.
- Describe the basic activities, steps, and concepts that will provide the foundation for the development of the Network.
- Describe the major network functions (end-user actions) that can be expected, and the supporting content, technology and cooperation required to achieve these functions.
- Outline our relationship to the national EPHT Network
- Present a number of alternative pathways to achieving our goals in a flexible manner.

1.2 Target Audience in New Hampshire

This Network Implementation plan is directed primarily towards those local, state, regional, and national Network partners who will make up the core users of the system and who will need a concise and detailed understanding of their role in the Network. We have identified these players via a stakeholder assessment process comprised of an expert Advisory Council, a Workforce Assessment survey of over 300 environmental health professionals, and a Database Inventory of data stewards and decision makers for our three priority areas of air quality-asthma, radon-lung cancer, and drinking water-health effects.

In addition, this written plan is intended to provide our cooperative partners at CDC with a clear picture of our readiness as a State Network that will eventually be tied in with a co-evolving national EPHT Network. And finally, we have written this plan for our bosses - MAC, Jose, Chris, Karla and others who require a better understanding of our program vision.

1.3 Processes Used to Develop the Plan

As discussed in our Target Audience section, development of the plan involved ongoing guidance from a variety of players. Primary among these players was the CDC national EPHT office staff, monthly meetings with the Standards and Network Development Workgroup, interviews with current State data stewards, and significant involvement and guidance from the NH Office of Information Technology (OIT).

The alpha version of the National Network Implementation Plan (NNIP), developed via the CDC contractor, Ross and Associates (<http://www.ross-assoc.com>), provided essential guidance and structure for our State Network plan.

Early stages of the Network plan:

1. Guidance documents and discussion with the Standards and Network Development Workgroup (2002-06)
2. Cooperative development with NH OIT (2005-06)
3. Develop a draft OIT project plan for air quality and asthma (2004-05)
4. Guidelines within the CDC Cost Extension RFP (2005)
5. Guidelines within the national NIP (2005)
6. Complete final NH EHDIN plan to share with CDC and stakeholders (2006)

Later stages of the plan:

7. Begin using NH EHDIN plan for NH Network Implementation
8. Enter into OIT Unified Process or Joint Application Development sessions
9. Build hardware-software system for data exchange
10. Test system with exchange of environmental and health data, e.g., drinking water and dental caries
11. Analyze and report on integrated data set

2.0 Network Background, History, Context and Overview

2.1 Public Health and the Environment

Common sense and historical experience have taught us that environmental conditions such as clean water, fresh air, safe food and clean buildings are closely related to human health, but rarely do we track these two factors together. More commonly, public health agencies investigate environmental health issues on an intermittent basis in response to public outcry, unplanned exposures, or during an acute disease outbreaks such as food poisonings, chemical spills or perceived cancer clusters. The public health success of sanitation in food establishments, purification of public drinking water, management of wastes, and occupational health codes have reduced environmental illness drastically in the developed world. Yet, there are many environmental exposures that do not result in acute illness or rapid death, rather, low levels of pollutants can cause slow, silent illnesses such as lead poisoning, or complex chronic diseases such as asthma, allergy, cancer, or neurobehavioral problems. Improved environmental monitoring and disease surveillance often reveals the subtle associations between the two interactive realms of pollution and people. However, few systems exist at the state or national level to track the exposures and health effects that may be related to environmental hazards. In addition, those that do exist are usually not linked, making it additionally difficult to study and monitor relationships among hazards, exposures, and health effects.

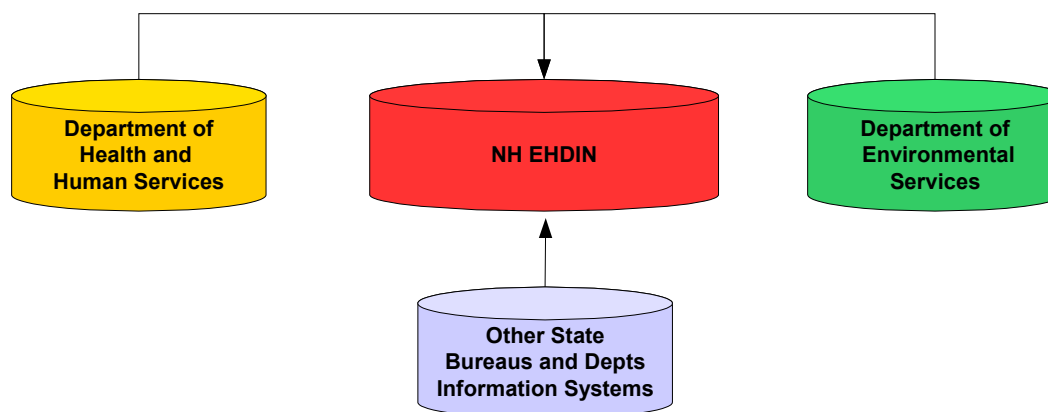
2.2 NH's EPHT Program and the Network

In an effort to integrate environmental and health data at the national level, the United States Congress appropriated funding to the Centers for Disease Control and Prevention (CDC) in Fiscal Year (FY) 2002 to develop the Environmental Public Health Tracking (EPHT) Network, a nationwide network of integrated state health and environmental data systems involving hazard monitoring, exposure biomonitoring, and health effects surveillance. The Network will provide valuable data that can be used to study the trends between the environment and health effects, the results may drive public health policy and actions that ultimately will reduce the burden of adverse health effects on the American public.

The success of the national network relies on the development of a two-tiered information infrastructure whereby state environmental health tracking programs essentially feed state data to the national Network. Therefore, the importance of developing an effective environmental health data integration system at the state level, in coordination with the national Network cannot be understated.

As an EPHT planning grantee, New Hampshire has begun developing an Environmental Health Data Integration Network (NH EHDIN) that will link existing state environmental and health data systems and facilitates the automatic exchange of electronic health effects data, environmental monitoring data, and exposure biomonitoring data. NH EHDIN will also provide public health officials; researchers, stakeholders and other users ready access to local, state and national level data to develop a better understanding of environmental public health interactions in support of policies and interventions. The development of NH EHDIN will involve the cooperation of multiple agencies, programs and personnel in the areas of public health, the environment, and information technology. As indicated in Figure 2-1 below, NH EHDIN will be integrated into a number of New Hampshire agencies.

Figure 2-1. NH Agencies involved with the NH EHDIN System



Requests for timely and complete analytical environmental and health information from environmental and health policy and decision makers for both the public and private sectors are increasing dramatically. To develop a transparent transfer of analytical data directly from the participating partners to the NH EHDIN would be a benefit to health officials, DES/DHHS, other state agencies and programs, and decision makers for the following reasons:

- ✓ More timely reporting of critical information for the participating programs
- ✓ Reductions in user intervention and speedier data transfers
- ✓ More consistent data sets for decision makers to access and use (especially among DES & DHHS programs and project partners)
- ✓ More accurate transfer of information and reduction of data entry errors
- ✓ Reduction in labor for the manual data collection and entry process
- ✓ Reduction in the use of materials such as file discs, paper and faxes
- ✓ Greater ease of data manipulation

The NH EPHT Program has been funded by CDC to establish a very specific Network, one that is a standard-based EPHT system that allows direct electronic data reporting and linkage within and across health effect, exposure, and hazard data, as well as interoperate with other public health systems. This system will facilitate the integration of data on environmental hazards, environmental exposures, and health effects to protect and improve public health. Integrated data will provide information to public health and environmental agencies, organizations, researchers, legislators, and others that can be used to plan, apply, and evaluate actions that prevent and control environmentally related diseases.

2.2.1 Gaps Addressed by NH EHDIN

As described within Chapter One, the NH EHDIN Plan has evolved within the context of the cost-extension RFP that outlined the 120-day plan to describe a State-based network. In addition, SND documents provided guidance on the Vision and metadata standards for the Network. And finally, the Network NIP produced by Ross and Associates provided a firm structure within which we could describe our Network plans.

In regard to the need for a NH EHDIN system, we expect that this Network will evolve to address some important gaps that currently exist in the statewide public information system. These include:

- ✓ A lack of standard operating procedures (SOPs) for handling data at the department level.
- ✓ A lack of standardized data, either from internal sources (using different standards) or external sources (requiring different standards).
- ✓ Limitations in data analysis between agencies due to a lack of systematization, consolidation, practicality, and system integration.
- ✓ No common system to track changes in data. No ability to determine cause and effect of programmatic changes. No ability to perform trend analysis across agencies.
- ✓ Existence of separate and disparate data systems lead to ‘blind spots’ in the information gathering or reporting process.
- ✓ State systems that track potential safety issues have data gaps that may hinder a response.
- ✓ Absence of integrated administrative systems. Burden of data collection and summarization is placed on individuals.
- ✓ Lack of a state agency data inventory. Managers and leaders have little departmental wide knowledge of existing data monitoring and projects.

2.3 NH EHDIN Coordination and Partners

The NH EPHT Program and NH EHDIN system have evolved in tandem with the national EPHT Program and National Network. As the National Network has used working groups to guide its development, so too has the NH Program used expert advice and citizen involvement to guide our process.

2.3.1 Coordination with CDC

The NH EPHT Program works closely with the CDC national EPHT Branch via Mary Odom, Public Health Advisor, and a number of other technical staff members who participate on the various workgroups and planning committees.

2.3.2 Involvement in SND Workgroup

The National EPHT Standards and Network Development (SND) workgroup has struggled to define ‘the national EPHT Network’ in a manner that is understandable to grantees and feasible in terms of functions, technology, content and coordination. The discussions produced many opinions on the best way to serve all the state and national partner, and resulted in a number of guidelines that have been accepted by the SND workgroup and presented to the various partners and grantees. The key written products that resulted from these labors includes the SND Principles, Network Vision Document 1.0, and the Network Architecture models (<http://www.ephtn.org/documents>). The concept of the Network has evolved most completely in the network architecture document where options are pre-

sented for data query and retrievals. Scenario 1 is based on a model where user-requested data is located on the CDC Network at the national level. Scenario 2 is based on a model where user-requested data is not located on the CDC Network and the request is routed to a partner-network. It is likely that the first scenario will be used for data that is common to all states (such as air quality and asthma), and the second scenario will apply to data unique to certain states, such as radon-lung cancer data sets.

The NH EPHT priority areas of air quality-asthma, radon-lung cancer, and arsenic-bladder cancer were chosen via a two stage process of assessing stakeholder needs and the quality of data available to track each environmental health issue. In the first phase of stakeholder needs, NH citizens have come together at least three times in facilitated priority setting processes to determine the comparative risks and impacts of environmental issues. These three events were collected into a matrix of over thirty possible priority areas in order to compare similarities and assess feasibility. In the second phase of our priority assessment, we completed a Database Inventory in order to assess the available data and data gaps in the system. As part of this database process, we were able to develop our data acquisition plan by comparing the existing data gaps with our ability to reasonably access and link data sets. The results were a model for gathering better environmental, health effects and behavioral data for the key areas identified above. Further reading on this issue can be found in the Database Inventory located on our website. (<http://www.des.nh.gov/EHTP/>)

2.3.3 Additional Partner Workgroups

The NH EPHT Program has been involved with four other CDC-established workgroups of members from the grantee organizations in order to develop approaches, standards, and protocols for EPHT. These groups include the SND and others listed below.

- The **Program Marketing and Outreach (PMO) Workgroup** develops education and outreach materials that emphasize and support the goals, objectives, and timely promotion of the national EPHT effort. NH staff member Laura Holmes has been an active member of this workgroup.
- The **Data Linkages Workgroup** was established to compile and share “best” and “worst” practices that have been utilized in linking health, environmental hazard, and exposure data. The Data Linkages Workgroup produced recommendations and lessons learned in the areas of asthma, birth defects, lead, cancer, and pesticides. Its tasks are complete, and it is no longer active. NH staff member Richard Rumba participated on this workgroup.
- The **Legislation and Partner Agreements Workgroup** addressed legislative and policy needs to enable development and implementation of state and national networks. Participants helped to create a legislative and regulatory assessment document and produced a bill writers “toolkit” to suggest language and approaches for developing state legislation about tracking. The workgroup’s tasks are complete, and it is no longer active. NH staff member Neil Twitchell participated on this workgroup.

2.3.4 Coordination with other NH Partners

The NH EPHT Program created two workgroups to guide its development. The first was the NH EPHT Advisory Council, set up to provide input on the evolving system and goals,

as well as review certain work products before they were released to the public. In addition, the NH Environmental Epi Team acted as a subgroup of the Advisory Council and provided research direction for the pilot projects and reviewed results before they were presented to the Advisory council. In addition, the NH EPHT program works closely with the NH Asthma Control Program, and the Northern New England Environmental Health Association.

2.4 New Hampshire 'Readiness' to Implement the Network

In order for the national EPHTN to function well, the grantees will need to be prepared to interact with the national level by agreeing on standards and developing a capacity to send and receive data. New Hampshire is ready to join a national network on a number of different levels. The Network contractor, Ross and Associates, has completed an informal assessment of grantee readiness based on conversations during the grantee site visits and teleconferences. NH EPHT Program shared information regarding our current activities, relationships, and network assets. The following section follows the National NIP guidelines in six 'readiness' categories: institutional relations, current data sharing, technical infrastructure, data discovery, grantee standards, and "morale." We attempt to measure our progress in the areas below by using a scoring of high, medium or low readiness.

2.4.1 Institutional Relations

The NH EPHT Program has a high level of institutional relations. We have established formal working relationships between our offices within the State DHHS, and the State Department of Environmental Services, as well as the State Office of Information Technology (OIT). We are currently purchasing 'services' from OIT for the development of this Plan and the Network as an alternative to the cumbersome hiring process. In addition, we are funding two local health departments to develop environmental health tracking infrastructure and capacity for the transfer of data from local to State agencies. Contractors and the State OIT have the necessary expertise in the underlying network technology that is so critical to developing NH EHDIN. The NH EPHT Program is poised to use all of these relationships to achieve interoperability with the National EPHT Network.

2.4.2 Data Sharing

The NH EPHT Program has a medium level of data sharing. Our current data sharing with public health agencies includes two Trading Partner Agreements with the NH Office of Medicaid Records for hospital discharge data, and the NH Health Statistics section for state Cancer Registry data. In addition, we have a Memorandum of Agreement (MoA) with the NH DES that allows us access to radon sampling data set, and public drinking water data. The NH DES One-Stop website also allows us access to other environmental agency data sets such as fixed facility storage and releases, and beach inspections/closures. These three agreements on data sharing are a measure of our "institutional relations," and represent a relationship between trusted parties—a core function envisioned for NH EHDIN.

2.4.3 Technical Infrastructure

The NH EPHT Program has a low to medium level of technical infrastructure. Our technology and technical infrastructure includes factors such as data access, metadata tools, security infrastructure, data analysis tools, and our content/storage capacity. The Program has purchased or accessed SAS and SPSS software for the data management and data analysis needs that we have for pilot projects such as radon/lung cancer or air quality/asthma. In regard to data sharing technology, we currently depend upon partner agency technology to achieve most of our data access capacity. We have budgeted and begun the process of acquiring hardware and software for the data transfer and storage. In regard to GIS capacity, due to specific State rules within DHHS, we continue to rely on external resources to generate maps for some of our pilot projects. In regard to our implementation stage of the EPA Exchange Network, or the CDC PHIN system, our State environmental agency partners are currently exchanging data on fixed facilities and beaches, and plan to implement data flows for public drinking water and outdoor air quality within the next year. Overall, we believe that our technical infrastructure indicates that we are in the ‘innovative early adopters’ phase as defined in the National NIP.

2.4.4 Data Discovery & Metadata

The NH EPHT Program has a medium level of data discovery. We have two query driven discovery tools operating within New Hampshire for access to environmental and public health data. Although we have not developed our own metadata tool for the NH EHDIN system, we are learning about systematic ways of collecting metadata and/or development of a metadata registry, factors that play an important part in using the network to find data and information held by partners. Although we do not yet have a well-developed metadata system, we have ways to discover and identify data sources.

2.4.5 Data Standardization

The NH EPHT Program has a low to medium level of standardization. On the environmental side of our equation, NH has been standardizing data to the EPA Exchange standards for well over two years. On the public health side, NH has not yet adopted a national standard such as PHIN-MS. A number of public health programs are in the process of piloting PHIN standard-based system, but are still developing the capacity to manipulate all data fields. The NH EPHT Program will continue to support the creation, use, and promotion of data standards within our State offices as a means of improving the system and selling improved data management. In addition, the NH EPHT Program will continue to discuss the best process for standardizing data within the SND workgroup.

2.4.6 NH Team ‘Morale’

The NH EPHT Program has a high level of morale and enthusiasm for Network implementation and success. As demonstrated in our commitment to attend monthly SND meetings, NH staff have sought out a better understanding of the principles and tools that guide the development of a State-based network. In addition, we have attended all national EPHT meetings and a number of day-long SND workshops intended to craft a more focused and standardized network at the national and state level. NH staff have also been involved in the development of the SND Vision Document 1.0, as well as, involved in the testing of a

prototype EPHTN data entry web portal. In addition, NH held a site visit with Ross and Associates on September 13, 2005 in order to explain how the Network is evolving in New Hampshire and how we believe the national Network should blend with our cooperative needs. Our level of enthusiasm for the Network development is rooted in the success of our funding and resource acquisition, our ability to find, hire, and train excellent staff members, a strong continuity of leadership, and a focus on 'teamwork' in the development of our program products and services.

3.0 Vision and Goals

3.1 Vision of NH EHDIN

Our NH EPHT Program vision statement is broad and inclusive:

"Our vision is for New Hampshire to become a State where information on environmental health and illness is available to all citizens in a rapid, simple and high quality format, and where people enjoy a high level of wellness due to an abundance of clean air, pure water, healthy buildings, and safe food. "

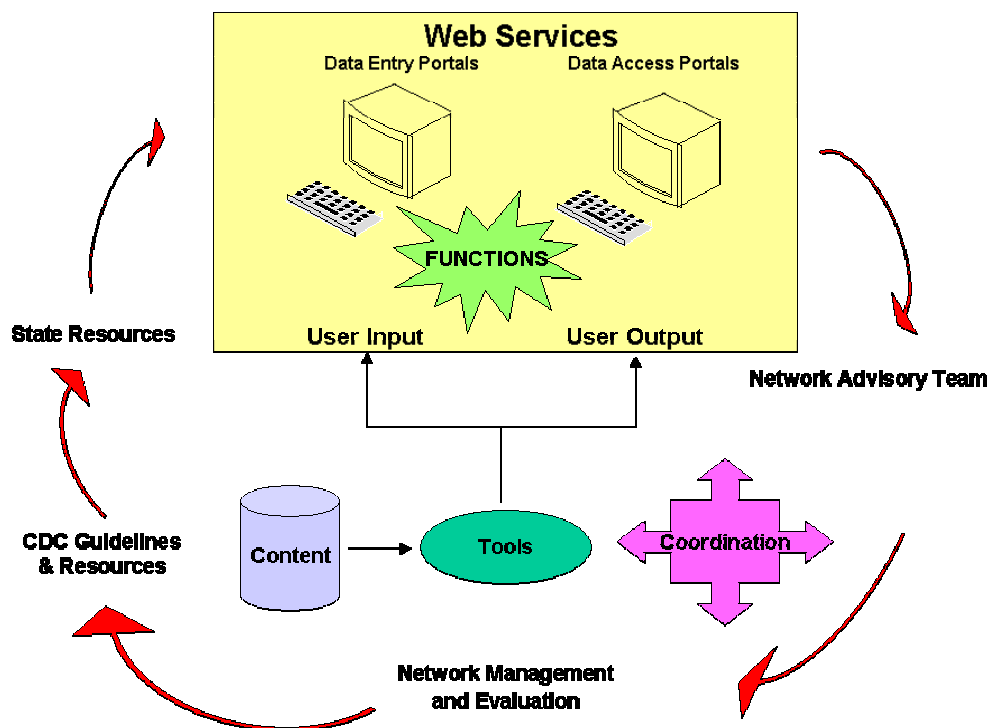
In comparison, the CDC vision is much simpler: *'Healthy informed communities.'*

The vision for the NH EHDIN data transfer system is even more ambitious:

"To become a single source of web-based integrated and automated electronic health and environmental data and information that will meet the informational needs of a diverse community of stakeholders in their identification and evaluation of policies and initiatives aimed at reducing the burden of adverse health effects on New Hampshire citizens and the American public."

In hindsight, we may have been a bit too ambitious in our vision, and it may be time to simplify our message in order to create a more understandable picture for our stakeholders. What will the vision look like when it is being implemented? The NH Environmental Health Tracking Program will be breaking new ground in the area of data exchange. For the first time, data from two state agencies will be linked and data published for its various publics. It is our hope that NH EHDIN will be a catalyst for other departments within our state to engage in the same type of information sharing. As outlined in Figure 3-1 below, the NH EHDIN system will be composed of functions that serve the needs of its users and will be supported by content, technology and coordination components.

Figure 3-1. Overview of the Network and its Functions



3.2 Goals for the NH EHDIN System

The goals of the NH Network are supportive of the goals of the NH EPHT Program. Development of the Network is the first goal of the state program, and a key element of accomplishing our vision. As indicated in the table below, the NH Network fulfills other goals of the program as well.

Table 3.1 Relationship Between NH Program Goals and the Network

NH EPHT Goals	How the NH Network Contributes
GOAL 1: Evaluate and improve State capacity to build an environmental public health tracking network.	<ul style="list-style-type: none"> Improved data collection increases capacity
Goal 2: Evaluate and implement geo-coding for databases in relation to our priority environmental health areas in NH	<ul style="list-style-type: none"> Supports geocoding of asthma/air quality, lung cancer/radon, bladder cancer/arsenic.
Goal 3: Develop a plan for the staged development of a standard-based EPHT system for the direct electronic data reporting and linkage within and across health effect, exposure, and hazard data that can interoperate with other public health systems.	<ul style="list-style-type: none"> NH EHDIN plan provides basis for development and implementation of the Network
Goal 5: Continue active participation in CDC's Program Marketing and Outreach (PMO) workgroup, Standards and Network Development (SND) workgroup, and any new workgroups that will discuss issues for implementation of EPHT	<ul style="list-style-type: none"> Ensures cooperative development of the national and state Networks Improves common messages
Goal 9: Develop partnerships with New England States funded under the EPHT cooperative agreements with the intent to standardize and share data on a regional level.	<ul style="list-style-type: none"> Encourage data exchange partnerships Create shared tools, methods and results
Goal 10: Develop a written response plan to improve the capacity of the EPHT Program to assist with 'critical' environmental health events such as chemical spills, Bioterrorism events and acute disease clusters.	<ul style="list-style-type: none"> Encourage data exchange partnerships Provides a repository for emergency response data

At the National level, NH EHDIN will fulfill the following goals:

- Become a viable partner in the implementation and sustainability of the National Environmental Public Health Tracking Network
- Provide nationally consistent health and environmental data to the National Environmental Public Health Tracking Network
- Become a conduit for the exchange of environmental and health data to and from the National Environmental Public Health Tracking Network

3.3 NH Network Business Case

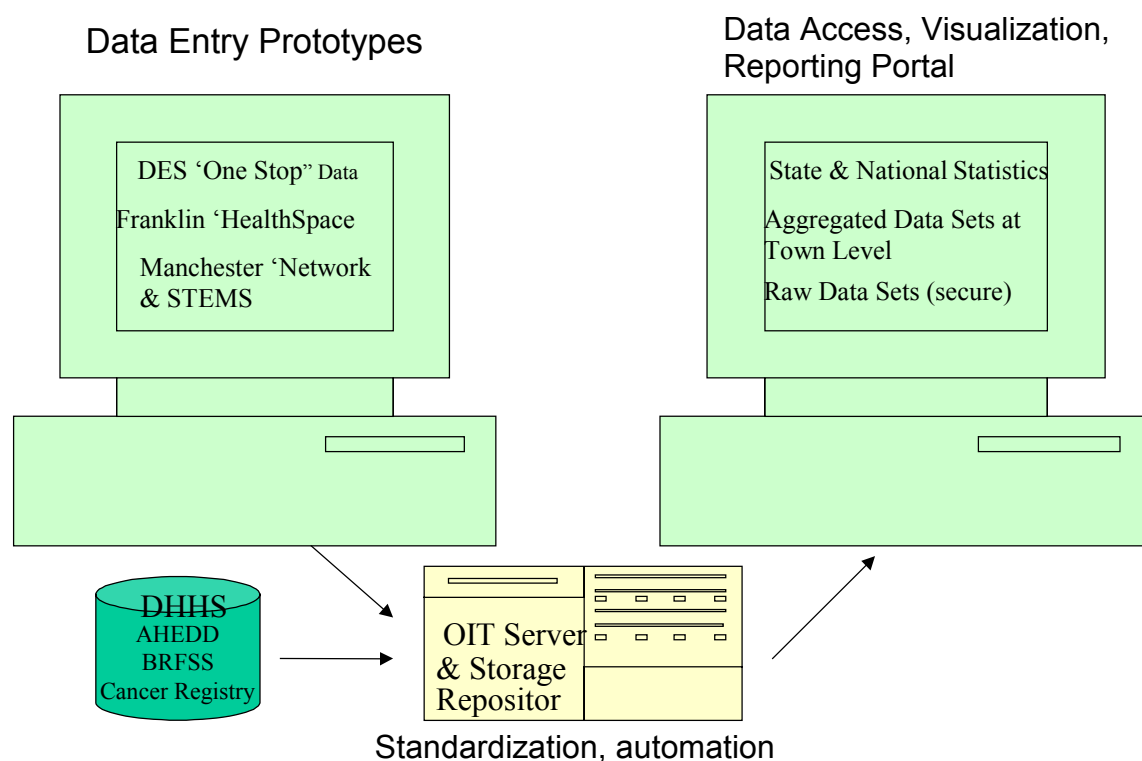
A business case provides the justification for development of the system. The long-term survival of the NH EHDIN will depend on its ability to improve the practice of environmental

public health by helping practitioners address real business or programmatic needs at the local, State and federal levels. The field of public health is rapidly evolving to include evidence-based practices that address essential public health services. Below are a few examples of business cases that exist in the State of New Hampshire.

- The state public health agency is interested in the potential environmental causes of asthma, but the state lacks access to data on known hazards and exposures. The Network can provide access to standard and geocoded data from environmental sources such as air pollution and outdoor allergens.
- The major cities within our state lack the infrastructure to collect, analyze, and compare data on health and environmental exposures at the local level. The Network can support routine data comparisons with adjacent cities.
- A State environmental agency needs to develop measurable indicators that provide a realistic comparison between health and environmental data. The Network can provide access to standardized data sets that allow for data analysis.

The primary business benefits provided by the EHDIN system will be two web-based services for input and visualization of environmental and public health data. As indicated in Figure 3-2 below, the system will provide access to data in a user-friendly manner.

Concept for NH EHT Web Services



4.0 Principal Network Functions

4.1 Background and Overview of NH EHDIN Functions

Network functions are those actions and decisions that get the network working, and in our case, they are actions that get data to flow. In many ways, network functions are a ‘customer-oriented’ view of the network. Consider this analogy: If NH EHDIN were a water distribution network, you could imagine that the functions or processes are end-user actions like washing, cleaning, or drinking. They all require that the designer and user come together at a moment to make an action happen. The network is set up so users can do something useful. A number of components come together to make these functions happen. In our Network, the content of clean fluid water is able to flow through technology, like pumps, pipes and gadgets, in a managed way that is controlled by a coordination team, made up of the architect, builder and plumber. Although not a perfect analogy, water provides a basic visual reference for us to work from.

Some examples of this type of data exchange network already exist. For example, the EPA Exchange Network uses many similar functions to gather, convert and transfer standardized data from States to the national level. Unfortunately, it is not a perfect model for the NH EHDIN or the national EPHT network. An EPHT network will need to develop two functions that go above and beyond the current EPA Exchange system. First, the network will need a function to standardize data as it passes *through* the system, rather than standardizing at the source of data entry or transfer. Second, the network will need to *integrate* various sources of divergent information, in order to allow the users to compare health and environmental data by time or place or other common characteristic.

The primary function of NH EHDIN is to serve as an environmental and health information management system that will allow users to perform actions such as data entry, access, transformation, and data comparison at their level of ability and interest. Within the Network will be a number of functions that will be designed by the Network manager and accessed by the users. In summary, NH EHDIN will provide the following principal functions:

- **Standardized Data:** The Network will produce data consistent with state and national standards, and users will be able to access and compare data.
- **Searchable Data:** The Network will be able to describe and discover metadata, and the user will be able to query the data sources.
- **Exchangeable Data:** The Network will be able to exchange data with various sources, and selected users will be able to enter, view or access the data.
- **Changeable Data:** The Network will provide online data manipulation tools, and the user will be able to adjust data to meet their basic data needs.
- **Cooperative Users:** The Network will have an external tool to foster collaboration and networking; users will be able to interact with each other.
- **Interactive Users:** The Network will inform and interact with its various public users; the users will be able to respond in simple ways.

4.2 Network Functions that Produce Standardized Data

4.2.1 Background on Standardization

One of the primary needs of NH EHDIN is to produce standardized environmental and health data and allow users to access and compare that data over time (i.e. view trends or associations). In other words, all the data in the system will need to look, feel and act in a similar way.

New Hampshire currently produces data that meets a variety of national standards, but lacks a broad network that provides standardization for integrated environmental and health data. The NH DHHS is currently in the process of building an automated data transfer system as part of the PHIN initiative, but has not yet implemented a data flow via an IT network. The NH DES currently transfers automated data on fixed facilities (e.g. hazardous materials, waste storage, etc.) to the national EPA offices, but is not yet able to link it to public health data.

There is a recognized need to produce standardized and integrated data at the national level and state level that will remedy data inconsistencies, such as those outlined in the Pew Commissions 2000 report (<http://healthyamericans.org/reports/files/healthgap.pdf>). There are examples of integrated networks that track environmental and health issue together, such as the NH Child Lead Poisoning Prevention Program (CLPPP), but these systems are limited in that standardized environmental data is entered into a common database in a prospective fashion, but does not allow for retrospective standardization of data sources.

4.2.2 Definition of National Standards

National standards are a set of procedures that ensure data is comparable between varying locations and timeframes and able to produce useful analysis, such as trend data. Much of the standardized data of value to the NH Environmental Health Tracking Program, and that will be incorporated into NH EHDIN, reside within the NH DHHS and the NH DES. A major source of this data results from required federal reporting. This data is standardized to meet national reporting requirements requested by a national program and consists typically of columns and fields that make up a record that becomes part of a file. In most cases, the agencies have adopted the national standards and operate within these set standards. For example, in the drinking water bureau within NH DES, bacteria tests on public drinking water supplies are performed monthly. There are established procedures to take the water sample and preserve the sample, as well as set standards to test the sample. Reporting of the results are also in a standard format. NH has developed computer programs to record the samples and the tests that were performed on them, as well as to track the gathering and progress of the samples. These are all captured and entered into the state drinking water database. Examples of the national standards can be found at the EPA Exchange website (<http://www.exchangenetwork.net/>).

4.2.3 Examples of Network Functions that Produce Standardized Data

NH DHHS and NH DES both produce a limited amount of standardized data for required state reporting to national agencies such as the CDC and the EPA. The vast majority of health data and a significant amount of environmental data at the state level in NH is not standardized to any national code. Currently, both NH DHHS and DES are investing resources into employing PHIN and EPA Exchange technology to standardize and integrate their databases. NH EHDIN aims to collaborate with these two agencies by utilizing existing technology and information.

EPA Exchange Overview

The EPA requires states to report environmental data within EPA standards. Within NH DES reporting requirements have been established that meet EPA standards. Subsequently, DES programs need to fulfill these reporting requirements and conform many of their database and computer programs to these reporting requirements. For example, the NH DES' Water Resources Bureau is required to report facility or source information to the EPA on a quarterly basis. This information is extracted from the NH DES Drinking Water database in the required format for the EPA program. However, as NH DES programs evolve over time it is inevitable that the state system may not stay consistent with the national program. In that case, the NH program will need to map state data fields into the national fields. This is time consuming and requires cooperation between program staff working with technical staff to achieve the correct file format. In general, a solution can be found by writing data extract programs to pull the data from the state system and transform it to fulfill the national requirements. In past instances, this has been successfully accomplished.

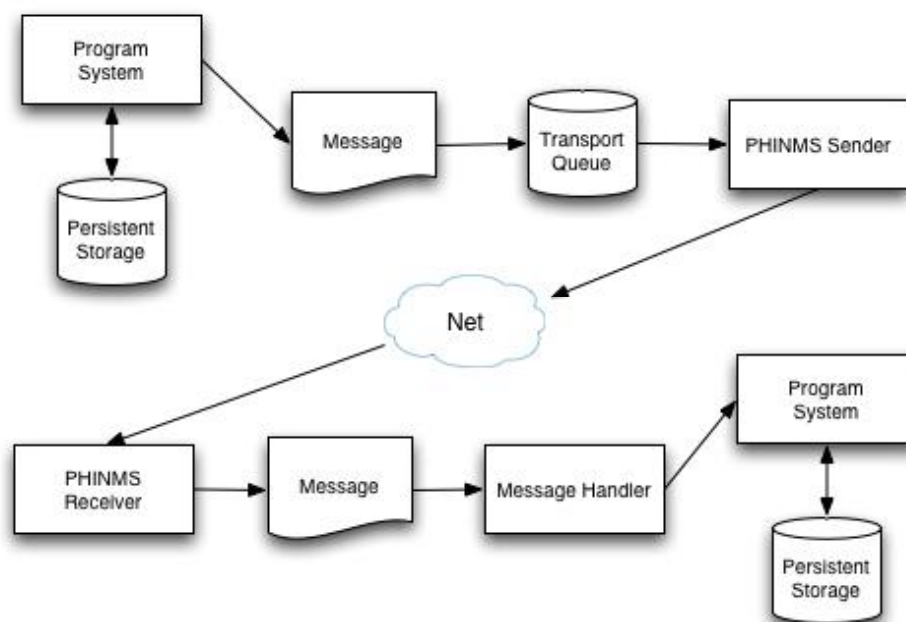
Also, the EPA has introduced new file formats and transport formats via the Exchange Network. As a result, NH has been modifying business rules and schedules to fulfill these new requirements. It has been a long process; however by standardizing on the XML format, NH will be able to standardize all bureaus within NH DES to one file format. For the technical staff that support creating these files, it will mean developing a common way of extracting data that is easier to produce with less knowledge of the data.

Within NH DES, linking of data from the state system to the national system is typically a long one. It usually requires both a program person and a technical person sitting down with a XML XSD file and going through it in order to map those fields back to the state database. There are many times that data sources requested by the national system are not self evident in the state system. Via a labor-intensive process, the NH DES State system generally can be adapted to meet these national requirements. Even though the original requirements for data collection were directed from the national level EPA, they will often ask for data that does not exist within the state system. In regards to publishing data, once the data has been identified, it must be published in EPA exchange XML files. The files will typically have an Excel spreadsheet that is downloadable so that when the state is mapping the state system to the national it will be apparent what the national system needs. When the state is requesting data from data providers the state will typically add a document that further describes these fields to allow the report.

PHIN-MS Overview

In regard to standardization functions for users of public health data, the NH EHDIN and the national EPHT Network are anticipating using similar data formats. There is an evolving concept and standard called the *Public Health Information Network Messaging System* (PHIN-MS), based within the Centers for Disease Control (<http://www.cdc.gov/phn/>). PHIN-MS currently consists of two main components: a client that can run on a typical workstation, and a server that must be run in conjunction with a Web server. Both pieces are written in pure JAVA and are certified to run on a number of typical platforms. The client is capable of sending and receiving (using a ‘pull’ method) messages at any time, receiving acknowledgements to those messages, and receiving messages with the help of a central server. The server is capable of both sending and receiving messages at any time. As indicated in Figure 4-1 below, public health or environmental data can be standardized via a function that involves a coordinated PHIN-MS sender and receiver network. In this way, data can be ‘pulled’ from an existing source of data and translated as it enters a new server or persistent storage location.

Figure 4.1 Functions of the PHIN-MS Sender and Receiver Components



As shown in the figure above, the interface into the messaging system is through message “queues” that allow almost any application, written in any language, to make use of the system. For example, to send a message as an XML document, the application places the file into a database queue or directory along with some addressing information. The PHINMS client retrieves the file, places it in an ebXML wrapper, encrypts it and signs it if appropriate, and then transports it over the Internet to the designated receiver. The design-

nated PHINMS receiver receives the message, decrypts it, checks the signature, removes it from the ebXML wrapper and places the message in a queue of received files. The sending application does not need to know anything about the ebXML wrapper, since this is managed by the PHINMS client. Similarly, the receiving application does not need to know anything about the ebXML wrapper, since it only needs to pull the unwrapped file from the queue to get the message for processing. Any type of file may be sent using the PHINMS.

4.2.2 Implementation Steps for NH EHDIN Data Standardization

In order to reach full data standardization, the NH EHDIN will need to build upon the existing systems in place and develop new methods for accepting and storing a wide variety of data sources. At the current time, the most viable solution to this problem would be to use the 'PHIN-MS Receiver' concept and process as our data exchange standard. In this way, all of the data that was 'pulled' in would be standardized in a similar format.

Step One – Identify a NH-based system that plans to use a PHIN-MS Receiver or Sender as part of their process. In this way, we can learn about the utility and limitations of the system.
Step Two - Build a hardware/software system that is able to accept large payloads of data from both health and environmental sources.
Step Three - Test the system in order to see if NH DES environmental and NH DHHS health data can be pulled into our system in a high quality format.
Step Four – Analyze the data set to determine if the data are comparable based on the common standards.

4.2.3 Challenges and Solutions to Standardization Functions

Understandably, there will be significant technical and administrative barriers to reaching some common standards for health and environmental data. The EPA Exchange Network has demonstrated the ability to transfer standardized data, but from individual silos of data. At times there have been significant differences in the National EPA standards and the NH DES program in regard to the informational needs of the two programs. In these cases, one solution was realized by re-mapping the State data to the correct fields to produce the proper file for the EPA National system. This usually represents a significant amount of time for both the program people who are familiar with the state system and the technical people who query the database to align the two systems. This method combines the files and the skills of the program staff to ensure quality of the data being sent. To date, NH has been able to produce quality files in the required reporting periods. In regard to PHIN-MS challenges, the greatest barrier has been that while NH public health programs are testing the use of PHIN standards, they do not yet have a functioning data exchange system to beta-test (as of 1/06).

4.3 Processes to Describe and Discover Data

4.3.1 The Need for Metadata Functions

Due to the rapidly expanding nature of information in the modern age, the problem of having too much data available is often more significant than having too little. In time, we expect NH EHDIN to share in that experience. Hence, external users of the Network will need a function to help them understand, search and communicate information based on their interests. Similarly, internal Network managers will need to rapidly identify the data content—or metadata. In our plan, NH EHDIN will be able to describe and discover metadata, as well as enable the user to query the data sources.

4.3.2 Define Metadata Functions

For our purposes, we describe metadata as "data about data" that is used to describe the content, quality, condition, and other characteristics of data (<http://www.fgdc.gov/metadata/metadata.html>). We would add that a function of metadata also include that the information be easily searched, discovered and expanded. NH EHDIN will use metadata functions already developed by the EPA Exchange, PHIN-MS, the DES One-Stop Program, and the DHHS WRQS web query. We will also utilize guidelines produced by the national SND workgroup on metadata to build or expand the current metadata system in New Hampshire. <http://www.ephtn.org/mambo/>

4.3.3 Implementation Steps for NH EHDIN Metadata Functions

In general, State systems are 'program specific' or centered on the needs of the program's funder or users. Consequently, each program's information system has been build around the national or state guidelines that started the program. Inevitably the state and national system drift apart over time to create different needs at the state level verses the national level. When the state is to publish the acquired data it is necessary to qualify the elements being reported and displayed, even if the fields seem self-evident. For instance, a date field may be in different formats, the message of the displayed date is self-apparent. However, the date field may not clearly indicate what the start date is indicating. For example, in the context of a water sample being gathered, the start date may indicate the time the sample was collected, or dropped off at the laboratory for analysis, or the time the bacteria sample was due. These are fields that need to be further explained to the user that is requesting the data, or reporting the data. Depending on the data being reported, these fields are described further in different formats. For example, EPA exchange XML files typically have an excel spreadsheet that can be downloaded so that when the state program is mapping the state system to the national system, it will be apparent what the National system needs.

In regard to the specific steps towards development of a metadata function within the NH EHDIN system, we are in the preliminary phases of defining those specifications. The steps below are a beginning to the process.

<p>Step One – Define the metadata <u>content</u> by using an existing metadata standard or building one via the SND metadata core template and the metadata vision document</p>
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Step Two – Compare the metadata content to the requirements of PHIN-MS
Step Three – Build <u>technical query tool</u> to search data. Load the metadata template onto the NH EHDIN system
Step Four – Test the ability of the metadata tool to identify and describe data
Step Five – Test the ability of a query tool to extract data with a metadata tool. Change or adjust the metadata bases on a <u>coordinated</u> team process

4.3.4 Challenges and Solutions to Metadata Function

As stated earlier, one of the main challenges of metadata functions is to supply information to the user in a manner that they prefer. In the initial stages of NH EHDIN network development, we will be using various metadata functions from query engines such as EPA Exchange, DES One-Stop, and DHHS WRQS. As we develop our own internal capacity to serve up linked data, we will create a metadata function that fits the needs of our users at the State, regional and national levels.

4.4 Processes to Exchange Data

4.4.1 The Need for a Data Exchange Function

In order for the network to be valuable, there is a clear need for data that is exchanged rapidly between state, regional, and national partners. The Network will need to be able to exchange data with various sources, and selected users will need to enter, view and/or access the data. Although data is often exchanged via file transfers in New Hampshire, the automated web-exchange of standardized data will lead to greater efficiencies, reduced errors, and improved access by users.

4.4.2 Definition of NH EHDIN ‘Data Exchange’ Function

The EPHT Standards and Network Development Work Group defines Data Exchange as the “Bi-directional movement of data, between partners or other Network participants.” For our purposes, we describe a ‘data exchange’ function as the actions that guide the automatic process of moving electronic data across the web, in contrast to the current system where files are transferred via a private internal network with no need for user certification or advanced security precautions. By using the web for data exchange the information will need to be standardized in either XML or HTML formats, additional security precautions will need to be developed and users will need to be authenticated to receive data. In addition, the information will be automated so that it can be ‘pulled’ in from an external data source, or ‘pushed’ out to secure users and the National EPHT Network.

4.4.3 Network Functions for Data Exchange

A data exchange function within the Network solves the problem of having to manually link data in a slow and onerous fashion. NH EHDIN will enable authorized users to input data into the system via a web portal, exchange the data from the point of entry to the user as well as receive data via the web.

Within NH DHHS currently, linking and transferring of data from our state system to the national system is completed on individual systems for communicable disease, hospitaliza-

tions, vital statistics, the cancer registry, and other data sources. Recently, NH DHHS has improved the transfer of data in a number of areas. In regard to inpatient/outpatient data, a Unified Data Set has been developed which will blend records from hospitals, Medicaid, and other sources. In regard to claims data, a NH Comprehensive Healthcare Information System (CHIS) is being developed which will blend records from hospitals, Medicaid, and other insurers. DHHS maintains a data warehouse in the Office of Medicaid Business and Policy. This warehouse acts as an operational data store and a data mart for vital records data, elderly and adult services data and other administrative data. Birth and death data are exchanged from the Division of Vital Records Administration.

At the national level, birth and death data are electronically retrieved to a national dataset within the National Center for Health Statistics on an ongoing basis. Similarly, a random subset of data from New Hampshire hospital discharge data becomes part of the Uniform Hospital Data Discharge Set (UHDDS) at NCHS. Data from the NH State Cancer Registry is submitted annually to NCHS. An annual extract of data from the NH Childhood Lead Poisoning Prevention Program is submitted electronically via email (zipped database file) or an ftp site to the Lead Poisoning Prevention Branch of the Center for Disease Control and Prevention for integration into a national surveillance database.

Currently within NH DES, there are many exchanges of data occurring via the EPA Exchange Network. Typically, there is a system design document for internal data exchange programs from bureau to bureau. Recently NH DES has developed the ability for external (outside the state) clients, such as fixed facility managers, to create and deliver electronic files to the state. NH DES needs to receive these files in a manner that can fulfill the CROMERR rule that has been put in place by EPA which governs the way states can accept electronic data if the data is reported in any way to the EPA. Within the EPA rule there are a number of processes that must happen before the data can be accepted from the client: a defined set of security steps must be in place, the client must be given the chance to rescind the transmission, and the client must be able to view exactly what was transmitted. As well, NH DES must create a Trading Partner Agreement (TPA), and within the agreement the following steps are clearly defined in order to ensure accurate data exchange: validity and enforceability, receipt, verification, date of receipt, re-transmission, inability to transmit, signature, and definitions. **Note:** It is OIT/DES policy to the CROMERR in-place in any electronic exchange.

4.4.4 Implementation Steps for Data Exchange Functions

In regard to the specific steps towards development of a data exchange function within the NH EHDIN system, we are in the preliminary phases of defining those specifications. The steps below are a beginning to the process.

Step One – Define the data exchange <u>content</u> to be moved from an existing source to the NH EHDIN network
Step Two – Develop a <u>coordination</u> agreement (TPA) to access the data, using common protocols, with security protection
Step Three – Obtain the <u>technical</u> specifications for data formats, standards and security for accessing the data via the web. Build the tools and <u>technology</u> to move data.

Step Four – Test the ability of the data exchange process
Step Five – Test the ability of the NH EHDIN system to store and transfer the data to national or regional partners

4.4.5 Challenges and Solutions to Data Exchange Functions.

A number of challenges have been identified above. In addition, environmental data exchange and health data exchange in many ways appear to be heading in opposite directions. Environmental data managers are seeking to provide more access to data and expanded data query capacity in New Hampshire. In some cases, there are restrictions on the exchange of data sets for the storage of hazardous materials that could be a target of terrorists. Managers of health data are restricting access due to legal and moral imperatives to protect patient privacy. Clearly, challenges to integrating data from these sources may occur when geographic or other personal information is available in one data set and restricted in the other. Our radon-lung cancer pilot project provides an example. Our current level of access to the DES Radon data set allows us to identify individual homes by street address. The lowest level of aggregation we can access from the NH Cancer Registry data set is Census Tract level. This not only restricts us from making potential individual-level linkages at the street-address level, but also inhibits our ability to fine tune the geography of cancer incidence in relation to "radon hotspots" within census tracts.

4.4.6 Additional References to Data Exchange Resources

The EPA exchange has many of the XML documents needed for data exchange with EPA, available at <http://exchangenetwork.net/exchanges/index.htm>

- **Central Data Exchange (CDX)**

CDX serves as the single point of entry for many environmental data submissions to the Agency. The CDX will support the National Environmental Information Exchange Network. EPA is working closely with reporting entities, States and Tribes to enable the electronic submission of data via the Internet.

- **Environmental Data Standards Council (EDSC)**

EDSC develops environmental data standards to promote the exchange of information among States, Native American Tribes, and EPA. This Web site provides the authoritative information on Council actions, environmental data standards and related information.

- **Exchange Network Website**

The Exchange Network website is designed to provide practical, how-to guidance on preparing for the Exchange Network, educate all levels of partners on how to get started and participate in the Exchange Network, foster the use of the Exchange Network, cultivate support for the Exchange Network, and provide a clearinghouse of resources related to information exchange.

- **Office of Environmental Information (OEI)**

OEI helps ensure that EPA collects high quality environmental information and makes it available to the American public. We provide guidance to assist the agency about the way we collect, manage, analyze and provide/allow access to environmental

information. By fulfilling these activities we expect that the public and policymakers can make informed decisions.

- **Centers for Disease Control and Prevention (CDC)**

CDC is one of the 13 major operating components of the Department of Health and Human Services (HHS), which is the principal agency in the United States government for protecting the health and safety of all Americans and for providing essential human services, especially for those people who are least able to help themselves.

4.5 Processes for Online Data Manipulation

4.5.1 Describe the need for basic manipulation

Providing raw or summary data is valuable, but there is also a need to provide users with a way to change data so it is more specific to their needs. Information is more widely available than ever, but users find that data is often difficult to change or manipulate. Users need network functions that include geo-coding, de-identification, and other means of changing the available data. Changeable data functions will make information more valuable to users.

4.5.2 Define online data manipulation tools

Data manipulation tools involve a variety of functions. At its simplest, web-based queries enable users to manipulate data by filtering selected data from a larger dataset.

4.5.3 Data Manipulation within the Network

We expect users of NH EHDIN to have a need to manipulate data within the Network in a variety of ways. Tools for manipulating data can be as simple as a query tool that extracts data of particular interest and provides it in a usable format, or as complex as data analysis and transformation capabilities. Data manipulation tools that we would consider for NH EHDIN include: reports calculating incidence or prevalence rates, ability to calculate confidence intervals, and data aggregation layers (years, town, HSA, county, zip code, all females etc). Mapping capabilities which would be useful include some pre-defined maps with the ability to add/remove labels, landmarks, dynamically change geographic or time aggregations, colors and variable groupings, and the ability to dynamically select zones of interest. Examples of some of these capabilities can be seen at the US Census website (www.factfinder.census.gov), the NH Birth Query tool ([NH Birth Query Tool](#)) and ATSDR (<http://www.atsdr.cdc.gov/hazdat.html>).

Currently, NH DHHS is developing the WRQS Project for access to online public health data. WRQS will include data manipulation functions that enable the user to search and retrieve information by a number of 'health effect' criteria, including environmental concerns such as maternal smoking. The output received via this function could provide a very broad or specific picture of public health status. Currently, the online data manipulation functions primarily reflect the needs of the community stakeholders and the NH DHHS offices. For instance, NH DHHS has developed a query tool for birth data that allows users access to aggregated town-level data ([NH Birth Query](#)). With this tool, birth data can be filtered by risk factors, such as low birth weight and mother's tobacco use. Death data will soon be added to this tool.

Figure 4.1 NH DHHS Birth Query Tool

Birth Data Query Tool: Step 1

Available Information	Select Geographical Area to Analyze		
	State Totals	By County	By Town
All Reported Births	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Low Birth Weight (Under 5.5 lbs)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Very Low Birth Weight (Under 3.3 lbs)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mother Initiated Early Prenatal Care	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mother Initiated Late or No Prenatal Care	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mother Unmarried	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Medicaid Payment for Delivery	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mother Used Tobacco	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mother's Education Less Than 12 Years	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="button" value="Continue"/>			

The NH DES One-Stop data manipulation functions include the ability to search and retrieve information by the criteria detailed below. The output received via this function could provide a very broad or specific picture of environmental quality. Program interests are primarily a reflection of the NH DES offices and EPA programs that gather this data ([NH DES OneStop/](#)).

Figure 4.2 NH DES One-Stop

Town	<input type="text" value="%"/>
Name	<input type="text"/>
Street Number	<input type="text"/>
Street Name	<input type="text"/>
Master ID	<input type="text"/>
County	<input type="text" value="%"/>
Program Interest	

4.5.3 Implementation Steps for a Data Manipulation Functions

In regard to the specific steps towards development of a data manipulation function within the NH EHDIN system, we are in the preliminary phases of defining those specifications. The steps below are an outline of the proposed process.

Step One – Define the <u>content</u> to be manipulated by specifying the data formats for inputs
Step Two – Develop the data manipulation <u>technology</u> that will act as a tool for query or analysis functions
Step Three – Load the tools onto the NH EHDIN system
Step Four – Test the ability of the data manipulation tool to handle data
Step Five – Develop a system for <u>coordination</u> that can vet new tools, set standards for user interface, documentation/support materials, and interoperability

In the early stages of its development, NH EHDIN will integrate existing data query functions as a preliminary step to the development of its own data manipulation function. For example, our NH EHDIN web portal may direct users to the NH DES One-Stop website in order to extract needed data. In the later stages of development, the NH EHDIN system will create its own internal online data manipulation function that integrates the content of environmental and health data, with tools for changing data (similar to One-Stop or WRQS), and develop a system coordination component for maintaining relevance to partners and users.

4.5.4 Challenges and Solutions for Data Manipulation Functions

As was discussed in the previous section on data exchange, there are restrictions in place for data manipulation tools due to the need to protect privacy or for public safety purposes. In addition, many professionals are competent with the use of their own data manipulation tools, and there is a risk that if too many tools are included, untrained citizens may analyze and draw the wrong conclusions from advanced data manipulation. Advanced analysis of data requires an understanding of environmental science, ecology, epidemiology and some familiarity with the datasets themselves. The NH EHDIN network is exploring the means for allowing for advanced data manipulation for secure users who have been approved for that purpose.

4.6 Network Actions to Foster Collaboration

4.6.1 The Need to Cooperate

Providing data is a key function of NH EHDIN, but there is also a need to provide users with a way to network and cooperate with each other. In order to create a network of cooperative users, NH EHDIN will have an external function to foster collaboration and networking, and users will be able to interact with each other. Just as information is more widely available than ever, interaction with peers is growing via email, web-boards, mail and cell phone use. The advantages of these interactions are clear, but they also provide a communication burden that causes stress and inefficiencies. Users need coordination functions that provide a means to network without creating a greater burden for communication. Users need to discover other grantee studies, lessons learned, and build common

knowledge in an efficient manner. Users also need to find experts and participate in discussions.

4.6.3 Define and Describe Efficient Collaborations

The first step towards efficient cooperation among users is to inventory the available avenues for collaboration and networking, use the best ones to support NH EHDIN, avoid or change the inefficient functions, and avoid creating redundant avenues for communication.

As an example of New Hampshire cooperative efforts with state, regional and national partners, we have listed several collaborative efforts below. These include:

- One-Stop program
- Exchange projects
- Exchange Implementation
- Exchange Challenge Grant for laboratory data
- Exchange Implementation for
- Beach Data
- Drinking Water
- Hazardous Waste Transporters
- Facilities exchange

Under the EPA Challenge Grant the NH DES was the lead agency in a multi-state effort among Northeast States (including ME, NH, VT, RI, and NJ) to assist laboratories and other stakeholders deliver electronic files into an automated, electronic state network. As an innovative and large undertaking, it required services of outside IT contractors to help with the organization of tasks and other needs. In addition, NH DES facilitated the creation of a stakeholders group with the primary responsibility of reviewing documents on system feasibility and other tasks that had a direct impact on the implementation of the system or any change to an existing report. As an example of its utility, the Challenge Grant advisory group made several very good observations that the state then acted upon. First was a recommendation for the evaluation of the client or user base. A survey was completed on the target laboratories to see what type of infrastructure existed to transfer data. Others suggestions from the advisory group included the need for a better ‘metadata dictionary’. In addition, many stakeholders knew that there are some discrepancies in EPA testing methods and recommendations were made to correct these errors before reporting data on the method.

4.6.4 Implementation Steps for Collaborations

In regard to the specific steps towards development of collaboration and networking functions within the NH EHDIN system, we have already begun the process of cooperative development of the Network with the necessary agencies. Some of the initial steps are outlined below.

Step One – Define the <u>content</u> of the network via the Database Inventory and

from meetings of the Advisory Council. Develop a mechanism to ensure quality of the content (standardization, etc.) and identification of the data, studies, and pilot projects within the Network. Expert profiles will be handled via University of New Hampshire Health Data Inventory.

Step Two – Identify the technology platforms for management of shared resources and user profiles. Develop technology for communication via the web or other interactive processes. Identify technology that will be used to operate the Network via discussion with the State Office of Information Technology.

Step Three – Develop a coordination team in order to bring all players together for the development of the physical network, resolution of privacy issues, and encourage participation via rewards.

Step Four – Develop an ability to hold meetings on the web via WebEx or similar technologies.

4.6.5 National Meetings and Regional Collaborations

One of the primary means of early collaboration among stakeholders had been via the SND workgroups composed of national EPHT partners and grantees. The SND workgroup utilized WebEx, conference calls, and shared storage of documents on a website in order to facilitate communication and learning. The main SND workgroup evolved into a network of subgroups to address complicated or larger issues that could not be discussed in the time allowed by the monthly SND meetings. In addition, whole day events were held in conjunction with the EPHT national conferences in order to debate key issues and demonstrate problems and solutions in a real-time environment. The New England EPHT grantee states (CT, MA, ME and NH) formed a regional collaborative that meets in person or by phone to explore shared concerns and plan for the integration of regional environmental health problems, such as inter-state air pollution and contamination of well or public drinking water supplies.

4.6.6 Challenges and Solutions to Foster Collaboration

A number of challenges and solutions were addressed in the narrative above. Again, the greatest challenge for collaboration may be information and collaboration overload. The system must be kept efficient as it grows in the number of users and partners. Solutions include the listing of effective collaboration mechanisms and avoidance of reinventing new discussion forums that address issues others are already working on. Of course, security of the information and protection of identifying information will also need to be resolved.

4.7 Processes to Inform and Interact with the Public

4.7.1 The Need to Inform and Interact with the Public

We expect NH EHDIN to be a web-based platform for the dissemination of public information regarding environmental public health issues and risk communication, as well as a

mechanism that will ease the burden of individual data requests made to the State, enable the sharing of findings outside NH EHDIN, raise awareness of NH EPHT, and facilitate communication with policy makers. Due to the various needs of our stakeholders and publics, the Network will need to supply data and information in a number of formats and levels. We expect to make certain datasets available to the public in a variety of aggregated formats (incidence, prevalence, rates, etc.) without having to receive prior authorization. As well, de-identified linked environmental public health data, mapped data, analyses, and other internally created products will generally be made available. As information is made public, we expect NH EHDIN to evolve in a way that will address some important gaps that currently exist in the statewide public information system.

4.7.2 Define and Describe any Current Public Strategies (not tools)

NH DES and NH DHHS are both implementing strategies toward making public information more available to users of their websites, specifically, DES One-Stop and DHHS Birth Query, both of which are being expanded. However, these systems do not provide data in a linkable format, nor do they provide linked data. NH EHDIN is unique in its design to serve both functions. For public consumption, NH EHDIN will focus on providing general information regarding risk communication for our priority areas of radon and lung cancer, asthma and air quality, and arsenic in drinking water and related health affects. Optimally, these communication strategies will correlate with other State communication efforts, such as posting a radon/lung cancer fact sheet during January, which is Radon Awareness month and the time when NH DES mails radon test kits to homes.

As with the Birth Query, we do expect to make aggregated health and environmental data available to the public. Because a large percentage of environmental data does not identify personal information, and much of it is or will be made available on One-Stop, it is likely that NH EHDIN will be able to make raw datasets available to the public. Whether NH EHDIN makes de-identified health datasets available to the public is an issue that needs to be determined by the Network Advisory Group in consultation with NH DHHS data stewards. We do, however, recognize the benefit of providing online access to frequently-requested datasets in reducing the burden of servicing requests to numerous State agencies, as is the current practice.

4.7.3 Implementation Steps to Create NH EHDIN Public Access

In regard to the specific steps towards development of a public access function within the NH EHDIN system, we have already begun the process of cooperative development of the Network with the necessary agencies. Some of the initial steps are outlined below.

Step One –Define the <u>content</u> of the network that will be available to the public via a process of assessing the needs of users (see the NH EHDIN Workforce Assessment), and whether the content will be interpreted or not.

Step Two – Identify the <u>technology</u> platform that will be available to serve information and tools to the public. Describe any interactive tools that will allow the public to feed information back to the Network managers. Develop content security procedures to ensure personal or sensitive information is protected.
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Step Three – Develop a <u>coordination</u> team and assign responsibilities for finding
--

and posting public content. Develop a system for moving secure data in a coordinated fashion
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Step Four – Develop an ability to assess the needs of the public in an ongoing process so that the Network stays current and relevant to users.
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4.7.4 Challenges and Solutions to a Public Information Process

One of the major challenges to a better public information process would be the lack of respect for standards and guidelines for interacting with the public. Final decisions on public information portals and press releases are often made by upper level management who may have little or no training on determining the needs of stakeholders. Often, the political will for ‘staying on message’ is more important than determining what the public wants and needs.

4.8 Principal Functions in Relation to Content, Tools and Coordination

In the following sections, we will describe how the six functions described above relate to issues of Network content, Network technology, and Network coordination. At times, the section headings may appear to be repeating what has been described in previous sections, but the narrative is different and specific to the issue at hand. We encourage the reader to continue to use the analogy of a water distribution system as you navigate the important concepts of content, technology and coordination.

We followed this format in order to ensure that we addressed each aspect of a complete Network, including the data standards, metadata, data exchanges, data manipulation, partner collaboration, and public interaction. In addition, the format more closely follows the beta version of the National Network Implementation Plan (NNIP).

5.0 Network Content

5.1 Background and Overview

5.1.1 Definition of Content

Content in NH EHDIN is defined as more than just raw data, it encompasses all the resource materials that can be used to better understand our priority environmental health issues and our stakeholders (see NNIP, <http://www.ephtn.org/mambo/>). Content includes a wide variety of materials such as data (information that can be analyzed), results, methods, expertise, and some tools for handling or manipulating the information.

What is the content in our system? Our choice of what to include in the NH EHDIN was determined based upon the needs of our expected system ‘users’ (surveyed constituency) and the National EPHT guidelines for appropriate environmental health data. We used the following three criteria to choose our priority content areas. 1) The guidance provided by a number of ‘comparative risk’ processes undertaken by NH stakeholder groups over the past decade; 2) a clear understanding of the quality and availability of data (via our Database Inventory); and 3) the stage or status of ‘automated data exchange’ that the system has or will achieve in the near future.

5.1.2 Content in the Network

As indicated in a previous section, we chose three linked environmental health areas for inclusion in NH EHDIN. These include: Air Quality and Asthma, Radon and Lung Cancer, as well as, Drinking Water and Health Impacts. In addition, we have included a number of datasets in order to include content that may be relevant to our stakeholders. In order to assess these linked issues, we evaluated fifteen (15) individual databases to determine if they were appropriate to include in the Network. The specific databases are listed in Table 1 on the following page.

Table 5-1 contains the databases that will comprise the initial content of NH EHDIN. In addition, it contains our progress on automating the Network into a true standardized, integrated and web-based format. When the table is read from left to right, it demonstrates a flow of information from source to user. The table is color-coded to indicate the stage of development for each Network component. Green shading indicates that the Network element has been accomplished, Yellow shading indicates partial completion, and Red shading indicates ‘not yet available’.

For example, the top database ‘DES Public Drinking Water’ represents one of the more complete Network content components as a set of public drinking water supply data. As indicated by the color in the table, we have assessed the “DES Public Drinking Water” in our 2005 Database Inventory (green shade), NH has access to the data (green), collection is ongoing (green), data is standardized to EPA Exchange network (green), we are still evaluating the Quality Assurance and Quality Control (yellow), we are still assessing its integration level, or lack of isolated silo data (yellow), data is automated for an EPA ‘pull’ of data on a monthly basis (green), data is web posted via the DES One-Stop ([NH DES OneStop.htm](#)), and query tools allow for some summary statistics to be generated by Net-

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work users (yellow). Other query tools of note include the DHHS Web Reporting and Query System (WRQS) that allows access to birth data ([NH DHHS Birth Query](#)).

Table 5-1. Content and Progression of the NH Network, January 2006

DATABASE Name	Inventory	Accessed	Ongoing Collection	EPA/PHIN Compliant	QA/QC	Integrated (no silo)	Automated	Web Posted	Summary Stats
DES Drinking Water			monthly					One-Stop	
DES Fixed Facility			monthly					One-Stop	
DES Beaches			daily					One-Stop	
DES Outdoor Air Quality			daily						
UNH Outdoor Pollen			weekly						
DES Radon in Air			annual						
DES Private Drinking Water									
Hospital Discharge Data									
DHHS hospital data AHEDD			daily						
NH Cancer Registry			annual						
NH Behavioral Risks BRFSS			annual						
DHHS Birth Query WRQS			annual					DHHS	
DHHS Vital Statistics			annual						
Manchester School STEMS			daily						
DHHS Biomonitoring Data			seasonal						
Network Progression ----->	early stages			mid-stage -->			network complete -->		

	not able to be completed (barriers)
	partially completed
	completed
	not yet assessed

Metadata definitions

Inventory	Data assessed as part of our EPHT database inventory (DBI)
Accessed	Data is accessible or we have a Trading Partner Agreement (TPA)
Ongoing collection	Data is collected on a daily, weekly or seasonal schedule (not one time collection)
EPA/PHIN compliant	Data is compliant to EPA Exchange Network or CDC PHIN national standards
QA/QC	Data is checked for quality assurance or quality control
Integrated (no silo)	Data is integrated with another data set, not in an isolated silo location
Automated	Data is automatically transferred via the web and a network node
Web posted	Data is posted to a public access website
Summary Stats	Data has summary statistics posted on the website

How is NH EHDIN's content linked to national and regional level content? As of January 2005, we have begun to integrate in a number of national level data sets, including the US Census demographic data and USGS radon layer GIS maps. On the regional level, we are cooperating with Maine EPHT Program to share data on outdoor air quality and pollen levels (<http://airmap.unh.edu/>). In addition, we are attending quarterly meetings with our New England EPHT partners to discuss shared data sets and other content-related subjects.

In regard to our link to the national EPHT Network, we have worked consistently with the Standards and Network Development (SND) workgroup to discuss the appropriate content at the national level. It is likely that the national EPHTN will contain content that has been

standardized state-to-state (USGS, EPA, etc.) or multi-year content that is too large to maintain at the State level (Medicare, Veterans Administration, etc.).

5.1.3 Environmental Data Sources Proposed for the NH EHDIN Pilot

Air Quality Data

The Air Resources Division of NHDES is responsible for ambient air monitoring and air assessment, air toxics risk assessment, quantifying air contaminant emissions from stationary sources, compliance determination, and developing State Implementation Plans (SIPs) for attainment of federal air quality standards. The Air quality data includes emission levels of CO₂, SO₂, NO_x, PM_{2.5}, PM, VOC, Pb and air toxics. The data is collected through different programs of the Air Resources Division such as Air Monitoring and Air Toxics Control Program. The NH EPHT system will retrieve air quality data through the One-Stop page on NHDES' website in pdf or Excel format. NHDES hosts this data in FOXPRO and Oracle database.

The NH EHT system will use air quality data to:

- Correlate ambient air quality with trends in asthma and draw conclusions on effects of air quality with occurrences of asthma in the citizens of New Hampshire
- Study trends in critical air pollutants

Radon Data

Radon is a naturally occurring, colorless, odorless, non-chemically reactive, radioactive gas. It is also a Class A carcinogen, specifically responsible for lung cancer. The NHDES' Radon Program is part of the Environmental and Occupational Health Division. The Radon Program is responsible for gathering information on indoor radon occurrences within New Hampshire and for disseminating information about where radon occurs throughout the state, the health effects associated with exposure to radon, and the various means of reducing radon concentrations in both the indoor air and in the water supply.

NHDES' statewide radon database consists of results of indoor radon test conducted by household residents. This data is hosted at NHDES in Excel and Access. NH EHDIN will access the data via a Trading Partner Agreement. The NH EPHT Program is interested in radon concentration levels for these reasons:

- Identify relative frequency of occurrence of elevated radon levels throughout the state
- Correlate radon concentration in air and water with trends in lung cancer and other health effects.

Drinking Water Data

Public water supplies are protected by NHDES by overseeing the operation of about 125 municipal systems, 500 residential systems, and over 1,100 systems that provide water for restaurants, motels, and campgrounds. The NHDES' Water Division conducts engineering

reviews of all proposals to develop or expand public water supplies as well as conducts regular water quality sampling, water facility inspections, and facility operator licensing.

The NH EPHT Program is interested in the concentration of arsenic in water supplies. Earth materials such as bedrock, sand, and gravel may contain arsenic bearing minerals and so there is a high probability that arsenic can get absorbed into the drinking water. Excessive exposure to arsenic levels in drinking water can cause thickening and discoloration of the skin, stomach pain, nausea, vomiting, diarrhea, and numbness in hands and feet.

Access to arsenic content in drinking water assists the NH EPHT Program in learning about trends in arsenic contamination of drinking water, both public and privately owned. Currently, The NH EPHT Program retrieves municipal drinking water supply data through the One-Stop page on NHDES' website in pdf or Excel format. NH DES hosts this data in an Oracle database.

Privately owned well water is tested by the NH DES laboratory on a fee-for-service basis and hosted by NH DES. Access to this data will be attained by the NH EPHT Program for use in the EPHT system via the Data Request process.

5.1.4 Health Effects Data Sources Proposed for the NH EHDIN System Pilot

Automated Hospital Emergency Department Database Data (AHEDD)

AHEDD includes four hospitals (Concord, Lakes Region General, Monadnock, and Wentworth-Douglass) that transmit de-identified emergency department data via a secure system to the State of NH data repository. Data will be stored, updated, and analyzed daily by authorized staff within the NH DHHS, Division of Public Health Services, Bureau of Disease Control and Health Statistics. Key project components include: capture of emergency department data, secure transmission of electronic data from four New Hampshire hospitals to the State, building of a secured data repository, analysis and reporting of automated syndromic surveillance, and automated alerting of outbreaks for DPHS.

Hospital Discharge Data

The NH DHHS, Division of Public Health Services, Bureau of Disease Control and Health Statistics analyzes information from the reported hospital discharge records and distributes statistical reports to government agencies and other requesting public and private organizations. The data is used to plan, administer and evaluate health and other programs. The hospital data are abstracted from medical records upon patient discharge and submitted electronically to the NH Hospital Association, which is under contract with NH DHHS to collect the data. Only those elements of the dataset will be exchanged that do not contain any confidential information. Data is collected from the three main levels of hospital service as described below:

Inpatient Data: The inpatient data set contains discharge records on all admissions for stays at NH acute care hospitals of 24 hours or more.

Outpatient Data (Ambulatory Surgery, Emergency Department, Observation): The outpatient data set contains discharge records for hospital visits for scheduled ambulatory surgeries, all visits for medical services when the patient is released from the emergency department and all observation stays in the emergency department after illness or injury.

Specialty Data: The specialty data set contains discharge records on all hospital stays at long term physical rehabilitation, psychological therapy and drug and alcohol treatment hospitals. Currently there are seven specialty hospitals serving patients in NH.

5.1.5 Data formats

- **Oracle:** Most of the data sources at NH DES are hosted in Oracle database. It is envisioned that majority of the data exchange and data storage will occur in Oracle format.
- **Excel / Access:** Few data sources at the NH DES such as Radon data and data sources at the NH DHHS such as hospital discharge data are hosted in Excel or Access format.
- **GML (Geographic Markup Language):** GML is an XML encoding for the modeling, transport, and storage of geographic information including both the spatial and non-spatial properties of geographic features.

5.2 Nationally Consistent Data Requirements

Regarding the three health effects identified in the NH Tracking program's priority areas, the four data sets employed to measure these effects are all part of national systems that require all of the elements listed above – availability, accuracy, consistency, comparability, documentation, and completeness.

Asthma prevalence estimates for the State and county levels asthma are from the NH BRFSS, which is part of the CDC-coordinated BRFSS program. Questions are common to all states, and interviewers are trained according the structured CDC interview protocol (<http://www.cdc.gov/brfss/>).

Asthma Exacerbation Incidence is derived from NH Inpatient and Outpatient hospitalization discharge files. These files are part of the NCHS Uniform Hospital Discharge Data Set (UHDDS), which offers a standard for data elements, record layouts, and reporting requirements that are common to all states (<http://www.ahrq.gov/data/hcup/>). Also, these data use ICD-9 codes as diagnosis codes, a standardized set of diagnoses used nationwide (<http://www.cdc.gov/nchs/icd9.htm>).

Lung Cancer and Bladder Cancer Incidence data are from the NH STATE Cancer Registry. The Registry is certified by the National Association of Central Cancer Registries (NAACCR) though the National Program of Cancer Registries (NPCR) (<http://www.cdc.gov/cancer/npcr/css.htm>). According to its Fact Sheet (www.cdc.gov/cancer) NPCR enables reporting of cancer data by age, sex, race/ethnicity, and geographic area – within a state, between states, and between regions. The fact sheet also cites NH in its very first example of how states are using cancer registry data:

A special study using state cancer registry data from Maine, Vermont, and New Hampshire is addressing concerns of high incidence and death rates of bladder cancer.... Data from this study will be used to estimate the extent to which various life-style, occupational, and environmental exposures explain the increased incidence and mortality of bladder cancer cases in these New England states.

Lung Cancer and Bladder Cancer Mortality information are from NH Death Certificate data, which is collected as part of NCHS's National Vital Statistics System (NVSS) (<http://www.cdc.gov/nchs/nvss.htm>). The NVSS has standard collection tools and methods, computerized cause-of-death coding, and highly centralized integrated data transfer and storage protocols. Lung Cancer and Bladder Cancer data are from NH Vital Records Death Certificate files, which are collected as part of NCHS's National Vital Statistics System (NVSS). The NVSS requires each state to employ standard vital event certificates, collection tools and methods including computerized cause-of-death coding and highly integrated data transfer and storage protocols.

Childhood Blood Lead Data is collected as part of CDC's Childhood Lead Surveillance data, funded through a CDC grant. There are standard data elements and quality criteria that are required for reporting and submitting this data. New Hampshire's data meets these requirements and more (<http://www.cdc.gov/nceh/lead/surv/database/database.htm>).

Environmental Lead Data is only collected in cases where a child's blood lead level reaches a certain threshold. Due to variation in lead laws and lack of required reporting, this data is not as standardized as the blood lead data.

Air Data: EPA regulations require all state environmental agencies to report air monitoring data the EPA Air Quality System (AQS). The AQS is EPA's repository of ambient air quality data. AQS stores data from over 10,000 monitors; 5000 of which are currently active. State, Local and Tribal agencies collect the data and submit it to AQS on a periodic basis. The AQS subsystem utilizes a relational database management system in a client-server architecture. A description of the collection and reporting standards required by EPA are available at: <http://www.epa.gov/ttn/airs/airsaqs/index.htm>.

Drinking Water Data is reported to EPA through the Safe Drinking Water Information System (SDWIS). SDWIS/FED is a database designed and implemented by EPA to meet its needs in the oversight and management of the Safe Drinking Water Act (SDWA). The database contains data submitted by states and EPA regions in conformance with reporting requirements established by statute, regulation and guidance. A "sister" system, SDWIS/State (Safe Drinking Water Information System/State version), is a database designed by EPA and the states to help states (and EPA regions) run their drinking water programs and fulfill EPA reporting requirements (<http://www.epa.gov/safewater/.htm>)

5.3 Local, State, Regional Data Requirements

5.3.1 Local, State, and Regional Data Standards

In general, datasets within NH DES and NH DHHS are not standardized to conform to specific State or regional standards. In most cases, the standardization that does take place (within the programs that steward the data) is a result of the conformity to national reporting requirements. The New Hampshire Database Inventory submitted in November 2005 provides a detailed description of state and local standards listed by individual data set. (<http://www.des.nh.gov/EHTP/database.html>)

Examples of local data standardization include a school-based system health record program called the State Tracking Encounter Management System (STEMS). The system is

based at the Manchester NH health department and managed by a contractor (<http://www.stchome.com/>).

Examples of state-based standards include the Automated Hospital Emergency Department Data (AHEDD) project where data is standardized as it is ‘grabbed’ from hospitals, because only particular data elements are required. Also, the New England Asthma Regional Council (ARC) is working on standardizing the definition of asthma prevalence regionally to make state statistics comparable and allow data to be combined.

5.3.2 Challenges, approaches, and solutions

Some of the challenges to standardizing data include a lack of resources, lack of training, and a lack of motivation. We propose a number of solutions to these challenges. One solution is to make funding contingent on standardization (as seen with the national data sets above). To address some of the other challenges, training and technical support regarding protocols and the reasons for standardization could be provided. Each of these solutions approaches the problem from the data collection and entry point. This point is a desirable control point to ensure data accuracy and completeness. Another solution at this point would be to limit data acceptance by using predetermined sets of data allowable in each field (town names, ICD9 codes, etc.) Alternatively, standardization could occur after the data has been collected, although this would likely result in the loss of needed data.

5.4 Requirements for Providing Resources on the Network

5.4.1 Requirements for the development of tools, studies, and results

New Hampshire shares an interest in providing access to best practices, methodologies and tools to manipulate and visualize data that have been developed for environmental public health tracking. As mentioned in the National Network Implementation Plan, categories of tools and methodologies that may be considered include:

- Data collection methodology/best practices
- Tools for describing data
- Metadata input tool
- Tools for analysis
- Linkage and data integration protocols
- GIS based tools, such as geocoding or spatial smoothing techniques
- Statistical tools
- Tools for reporting and visualization
- Mapping protocols/best practices
- Tools to facilitate data sharing
- Trading Partner Agreement templates
- Mapping protocols/best practices

- Best practices for community participation
- Risk communication methods and best practices
- Media communication methods and best practices
- EPHT 101 training

Requirements for providing these tools and methodologies via NH EHDIN include:

- **Describing** - The tools must be described in enough detail for others to use
- **Selecting items for inclusion** - A process to determine what is included in the NEPHTN is needed.
- **Controlling Quality** - Determining if quality control and review of items before posting is needed. If so, a process to do so is also needed.
- **Finding and accessing** - Tools and methods must be provided in a way that they may be found and accessed by network users.

Again, as mentioned in the National Network Implementation Plan, we expect to be able to provide access to study and project information as well as preliminary results of EPHT grantee and stakeholder studies. Requirements for this type of content would include:

- **Describing EPHT topics that others are working on** - The studies and results must be described in enough detail to be useful for others. Ideally participants would be able to understand challenges and lessons learned, results from linkage activities, associations (or not) among certain environmental hazards and health effects.
- **Selecting items for inclusion** - A process to determine the studies and results to include in NH EHDIN is needed.
- **Understanding Quality** - Establishing means to document and then understand the quality of what is posted on the Network is important. Processes/policies to do so are needed.
- **Finding and accessing** - Tools and methods must be provided in a way that they may be found and accessed by network users.

In general, data tools, studies and results must demonstrate due diligence in documenting and assessing previous research and/or data collection in the topic area and provide references or justification for departure from standard methodologies. We expect to provide access to the tools, methodologies, studies, and research results of our Network partners and stakeholders, such as the University of New Hampshire's Spirometry and Air Quality study and the NH DHHS Arsenic Biomonitoring Study, as well as to our own indicator and data analysis efforts.

5.4.2 Challenges, approaches, and solutions

Some of the challenges facing the development of tools, studies and results include how to approach proprietary or unpublished methodology and protocols, and verifying the reliability and validity of tools and studies. One solution to the proprietary challenges is to agree upon documentation and user accessibility to the tools, studies and results between the author and NH EPHT Program staff in the data TPA (trading partner agreement). Verifying the reliability and validity of tools and studies can either be carried out by NH EPHT Program staff or by submitting authors.

Other challenges reflect those mentioned in the National Network Implementation Plan:

- Diversity of EPHT topics of interest to grantees - The breadth of topics and resources of interest to EPHT creates challenges in the potential volume of information that must be described and managed. Identifying appropriate key words and specific topics of interest may be a challenge.
- Maintenance - Maintaining currency of tools and information will be challenging. As resources evolve, multiple versions of the same file may be available. Resources are required to update and keep materials current.
- Standards – Currently, there are no standards identified to document and search for EPHT resources.
- Ability to identify resources outside of grantees can be challenging, although of interest to EPHT. The incentives to engage these partners may be more limited than in the case of grantees.

Approaches to these challenges were also mentioned in the National NIP and include:

- Find or develop metadata standards for resources other than data. The Network could support a variety of functions for searching and gaining access to the tools, methods, studies, results and expertise (EPHT Resources).
- Develop a common vocabulary
- Provide a means to document situations where no linkages are found. Grantees were interested in learning when health-environment associations were NOT found as much as when they ARE found. An abstract reporting form for these situations could be developed.
- Develop database of grantee programs from October 2005 template. A grantee program database could allow searching on important factors such as hazards, exposures and health effects, methodologies.
- Develop a simple program summary form to capture basic EPHT grantee details (e.g., project leader, rationale, methods, results, outcome, follow up, contact information). The form could be updated annually.
- Develop a metadata registry tool for tools, methodologies, studies and/or results – provide links and contact information.
- Version control is available for some online management tools to show history of materials and versions.

5.5 Content on Expertise

As mentioned in the National Network Implementation Plan, there may be a desire for NH EHDIN to enable its users to input and query information identifying environmental health experts and their area of expertise. To do so would entail developing a web-based process within the system that would pre-qualify the person, create a form to complete, house that information, and enable that information to be queried by name, topic of interest, and address. As well, this information will need to be kept secure and regularly updated.

5.5.1 Challenges, approaches, and solutions

Providing content on Network expertise would be challenging for any system, but is especially difficult for a fledgling State Tracking Network. The amount of labor involved in tracking and updating each person's expertise would be significant. Additional challenges to including content on expertise were mentioned in the NNIP and include the lack of a standardized expertise vocabulary for EPHT, concerns of experts regarding protection from being inundated with questions, and the reluctance of experts to provide information and maintain their information on the system given their time constraints.

With this understanding, we have determined that the processes and manpower necessary to fulfill these functions is not initially feasible, however, we do plan to incorporate a web link to resources that may be able to provide the service for us, such as the New Hampshire Health Data Inventory, <http://www.nhhealthdata.org/>. The HDI already lists dozens of data resources within New Hampshire and provides contact information for stewards of health and environmental data sets.

6.0 Network Technology

As a web based data integration system, EHDIN will need hardware, software and other technical tools to make it operate. As a data and information service, EHDIN will need efficient and helpful tools that will provide to its users the functions described in Section 5. The following section outlines the technology infrastructure of the system.

6.1 Background and Overview

With EHDIN, the NH EPHT Program proposes to automatically exchange data from NH DHHS and NH DES from databases in regard to identified priority EPHT areas (see Section 5 Content) by incorporating the existing technological infrastructure and data exchange mechanisms of both agencies. The following technical components of EHDIN's proposed infrastructure have been organized into specific function areas based on the NNIP outline, our work with the SND Workgroup, and the needs of our Network.

- Availability of Data & Resources
- Management of the Metadata
- Ensuring Security
- Allowing Transport of Data
- Analysis and Transformation of the Data
- Tools for Collaboration

In the Overview section of Chapter Six (Ross & Assoc., 2005) of the National NIP, a concept design provides a clear relationship between the six technological components outlined above. The NH EPHT Program agrees that transport and security issues are overarching technological issues that play a part in all of the other technologies. Currently, we have not yet created a unique design concept for the technological infrastructure for NH EHDIN. As the system evolves, we will determine if the NNIP concept fits our needs.

6.2 Availability of Data and Resources

6.2.1 Tools for Accessing Data and Resources within the Network

Data is defined as the 'data sets' that contain standardized information on a particular environmental or health issue. Resources are defined as the tools, metadata, project descriptions, study methods, study results, and other project information, including information regarding involved stakeholders and their expertise. These definitions are similar to those outlined in the National NIP, although we hope they are a bit clearer in this format.

We expect EHDIN to be able to implement a tool that will allow users to easily locate and access data and resources in a uniform and consistent manner, similar to that of the NH DES One-Stop system, <http://OneStop.htm>. The data and resources housed in EHDIN will be regularly updated with new content and old or irrelevant content to be removed. Access to this information will be regulated as by authentication and authorization, as described in Section 6.4

As a small state, NH has the opportunity to implement EHDIN as a warehouse for NH DES and NH DHHS data sets in a single location with the infrastructure needs built into the application: registration, authentication, trading partner agreements, etc.

6.2.2 Publishing Data to the Network

To publish data within EHDIN, we propose to make data available to clients as a ‘web service’ with queries built into the pages. Data would also be offered as style sheets enabling the client to look at the data in different formats. We plan to use the following two systems as models for publishing data to EHDIN: the DHHS Birth Query Tool, <http://BirthQuery.htm> (see Section 4.5.3), that allows users of the DHHS website to access aggregated town-level data, and the NH DES One-Stop, <http://OneStop.htm>, a data information system initially based on the EPA Exchange system. Several years ago, NH DES established One-Stop and has since refined it to link all the sites from different DES bureaus into a hierarchical structure to which a GIS layer was added. Over the years, many different data sets have been added to this system, which today is the corner stone of NH DES’ Web presence to their clients. One-Stop is presently being expanded into a data entry portal where clients can feed additional data into the system.

6.2.3 Technical Approaches for Accessing Data

As mentioned in the National NIP, there are a wide variety of technical and policy options for making data available to the public or a specific group. The following are approaches we will investigate in the design and implementation phases.

Lifecycle Management

EHDIN will have technical controls on the data content from start to finish. From the perspective of the Network manager, lifecycle management gives the data owners control over the phases their data and resources can go through, including: data creation, publishing, transformation, archival and deletion. The data owners will be able to specify who has rights to move the data from one lifecycle phase to the other and may be able to specify how the data can be modified and by whom.

Publishing Management

EHDIN will provide technology that allows data (and resource) owners the ability to publish their data on the Network. The system will allow the data owner to specify the level of access to the data. In addition, active web pages will allow users to use a query tool to search the published data for relevant focus areas.

Static Web Pages

EHDIN will provide a number of options for viewing content in the system. For example, static web pages may include PDF documents, Word documents, and additional URL links.

6.2.4 Challenges and solutions to Web Publishing

One of the main challenges in combining environment and health data on the web is to ensure that users do not infer or conclude an association that may not be accurate or logical.

A solution to this problem would be to limit access to broader data sets for secure or approved users who can understand the data (epidemiologists, researchers, etc.).

6.3 Metadata Management

6.3.1 Technological Options for Finding Data on the Network

In order to find relevant data within the EHDIN system, we will need to create a tool to identify and describe the information within the data sets in a way that is standardized and convenient to the user. We have two options for creating this tool...

- **Proposed Tools for Metadata within EHDIN**

Based upon the lessons learned by the Metadata subgroup within the national SND workgroup, the NH Network will develop network metadata tools that reflect the evolving national network. Specifically, the EHDIN system will make use of the Metadata Tool Vision (<http://www.ephtn.org/mambo/C>) to guide the process of developing a State-based tool that reflects the needs of the national level EPHTN. In addition, the EHDIN project will ensure that any metadata tool reflects the requirements outlined in the Federal Geographic Data Committee's guidelines on metadata (www.fgdc.gov) as indicated in the EPHT Metadata Core Template.

- **Current Tools for Metadata within the NH DES/EPA Exchange System**

The NH DES system itself runs with an application called 'Context Sensitive Help', which is best defined as information for the client to describe a certain event or process that has occurred in the program. In other words, it can help the Network manager and users find information within the system that helps them understand and solve application issues. In the NH DES system, these help screens are generated in a similar manner for the registration process, and the WEB query method. The help screens will appear real-time as a confirmation. The information that the client entered will be validated and accepted, or there will be an error message. If an error, it will be displayed with the explanation of how to fix it. This will enable the client to rework the information and re-authenticate. Therefore our help documents and messages will be built into the different Internet screens this will allow easier installation of the system.

Metadata searches will be completed in a similar method, via online data dictionary built into the WEB portion of the system. The system will also provide a method of attaching data dictionary to the different method of information gathering that can be done with the system. Excel Sheets will have an additional worksheet with embedded data dictionary information. HTML will have online URL to hyperlink to data dictionary. Style sheets will also have URL references to data dictionary information.

6.3.2 Challenges and Solutions within Metadata Tools

The most significant Metadata challenge will be to standardize the Data Dictionaries between NH DES and DHHS in order that search keywords can be used to discover relevant

data within either system. In this way, users of the system will be able to determine which data sets exist that applies to their concerns. It is hoped that the PHIN-MS system will be able to extract data from various sources in a manner that ensures comparability. We plan to study the EPA Exchange Network to determine how they achieve standard Metadata terms across various data sources.

6.4 Tools for Data Security

6.4.1 User Registration/Authentication/Authorization Process

EHDIN will provide environmental health data to clients in both the public and private sectors via tools that protect data via registration of users, authentication before data is accessed, and authorization of the correct users. Levels of access to that data will be restricted based on criteria to be determined by the Network Advisory Group. Access by the public to general environmental health data will be made available. For all other clients we will institute a process of authentication via registration. The process flow is illustrated in Figure 6.4 and shows the technical steps that will need to be completed for the client to receive authority to authenticate to EHDIN. Once complete, the client will receive an email containing their permanent login id, pin and password. Registration requests will be reviewed by the NH EPHT Program staff and allowed or denied based on our understanding of the user needs and Network capacity. Details regarding the Registration process can be found in Appendix A.

6.4.2 Confidentiality

Due to the confidential nature of data we expect to receive from NH DHHS and NH DES, it is essential that EHDIN ensure that information being exchanged is only accessible to approved users. In order to achieve this, the Network will adopt robust technical systems that ensure information exchanged over the Internet is encrypted and cannot be accessed meaningfully by non-authorized users. This means traffic will need to be encrypted so that machines in the middle (of the web) cannot read the messages. Encryption methods can be divided into symmetric key algorithms and asymmetric key algorithms. In a symmetric key algorithm (e.g., DES and AES), the sender and receiver must have a shared key set up in advance and kept secret from all other parties; the sender uses this key for encryption, and the receiver uses the same key for decryption. In an asymmetric key algorithm (e.g., RSA), there are two separate keys: a public key is published and enables any sender to perform encryption, while a private key is kept secret by the receiver and enables him to perform decryption.

6.4.3 Non-repudiation of Users

For EHDIN, we expect to implement the NH DES best practices protocol (CROMMERR website located at <http://www.epa.gov/cdx/cromerrr/index.html>). Non-repudiation is the concept of ensuring that a contract or TPA, especially one agreed to via the Internet, cannot later be denied by one of the partners involved. Non-repudiation of origin proves that data has been sent, and non-repudiation of delivery proves it has been received. An alleged sender of a document is always able to repudiate, or refute, a document that has been attributed to him or her. So non-repudiation is a way of proving that the sender has authorized, or approved, the document electronically and the document has not been forged.

Digital Signatures are used to add a level of security that ensures that a sender or receiver of a message cannot later deny that the message was sent or received by them.

6.4.4 Security Management Models

Due to the integrated nature of multiple datasets in the EHDIN Network, it is likely that NH will use a combination of security measures (centralized, distributed or delegated) in order to provide appropriate access and restriction for different levels of users. In the pilot phase of EHDIN, we envision the Network will use a 'centralized' security model that will provide a level of access only to individual users have been authorized by an NH EPHT Program administrator. These security protocols can be implemented in different ways depending on the security model that is chosen for the Network. The options outlined below identify some high-level security models and their use-cases for authenticating and authorizing access to resources. At present, the NH central Security infrastructure for EHDIN is maintained and managed by the NH OIT.

- **Centralized Security Model** - In this model, entities on the network rely on a centralized security infrastructure to meet their authentication and authorization needs. Figure 6-1 shows that the Central Security infrastructure authenticates and authorizes a user who is then granted access to the requested resource. This implies that there is a strong trust relationship between the grantee and the Central Security and the grantee trusts the Central Security to evaluate a user's credentials and allows access to a resource based on that. As the Central Security receives the request first, this model also implies that resources from multiple grantees are being accessed and supports the concept of a Single Sign-On (SSO).
- **Distributed Security Model** (Independent grantee security systems) - In this model, each entity maintains their own security infrastructure and is wholly responsible for controlling access to their systems. Figure 6-1 shows that each grantee is responsible for its own security. A user requesting access to a resource is vetted by the grantees own security service before being allowed access.
- **Delegated Security** - In this model, entities have a trust relationship with the Central Security and delegate the task of authentication and authorization. Figure 6-1 shows that although the grantee directly receives a request for access to a resource, it delegates the task of authenticating and authorizing the user to the Central Security and if the user is whetted, it allows the user access to the requested resource.

6.4.5 NH Security Process

The scope of the security process is defined as it relates to the 'authentication' of the EHDIN Web site (not yet posted). From working with our technical consultant (Enfo-tech), and in-house knowledge, it is expected that this submission process will be granted CROMERR compliance. However, if changes are required it is within the scope of this project to make the necessary changes to enable the submission process to become CROMERR compliant. Security from the client to the application is achieved in multiple steps.

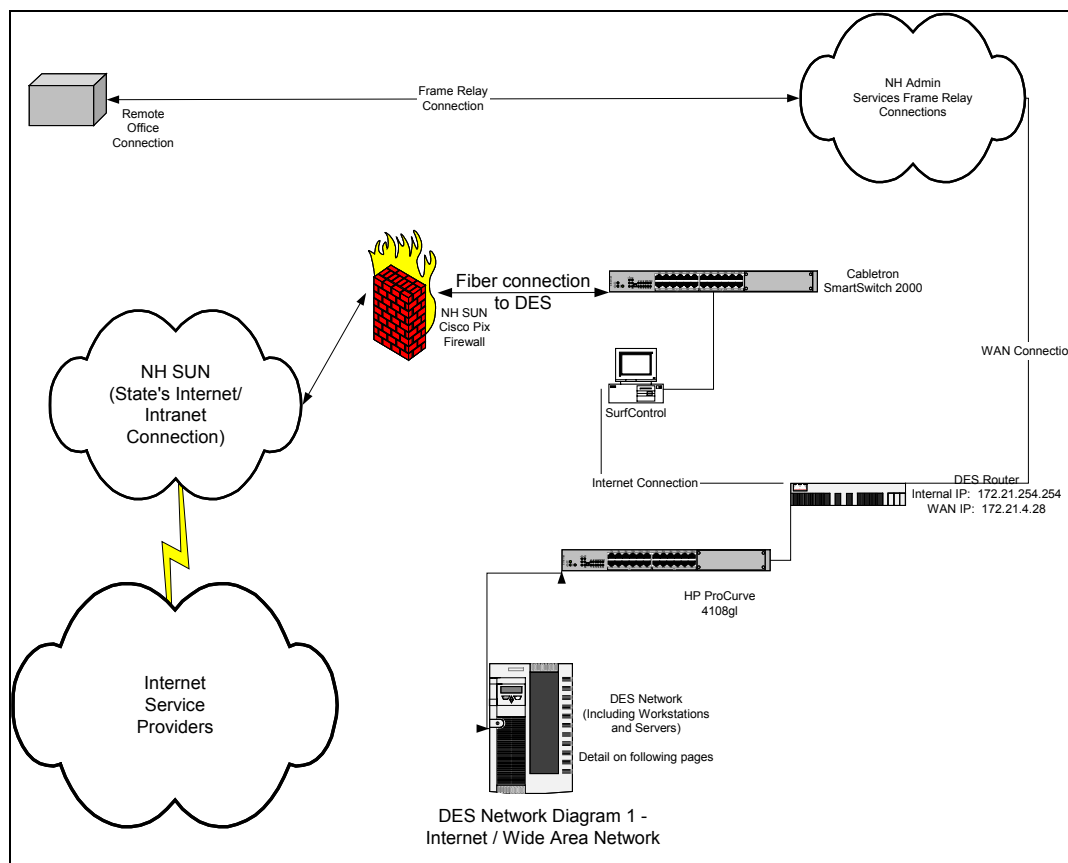
The first step in the registration process assigns user identification, pins, passwords and the NH EHDIN web site validates these upon the client trying to authenticate to the web site. In addition Health Tracking unit data stewards will be managing these accounts and have the ability to turn off access instantly.

Disclosure agreements will be set up with the registered users. This agreement will be a document that explains the details of the electronic exchange. The SSL port on the Web server will be utilized to encrypt the data being passed between the client and application. This will ensure that the information in this transferred will be unreadable outside this current Internet session.

Additionally, the submitting client has no control over the NH EPHT Program sending an email back to the registered applicant and facility. This information is stored on a separate computer within the Oracle database in DATAPROVIDER. This email would alert the valid registered client with any impropriety happening on there behalf. Logging of application use, every client that attempts to authenticate to the system is recorded and written out to a log file. This is tracked whether the outcome of the process was successful or unsuccessful. The client has no knowledge or control over this process. This authentication process is very dependent upon DES/HHS integrated systems. The system process will utilize the following NH computer devices: NH DES Exchange Network Node, NH DES Web Server, NH DES Mail Exchange Server, NH DES Alpha server, NH DES LAN and NH SUN Spot Wan.

Our system will make use of this interdependency, for example the user must register which uses the NH Web server. That process must insert that data into the Oracle database located on the Unix computer. Email is routed back to the original applicant, utilizing the NT exchange server. If some one wanted to gain unauthorized access they will need to do it on multiple machines. Although this in itself doesn't protect the application, it does add complexity to anyone trying to gain unauthorized access to the system. Further details of NH DES security management are outlined in Figure 6.1 below.

Figure 6.1 Security Management Model for NH DES/EPA Exchange Network



6.4.4 Challenges and Solutions to Security Tools

Two main challenges in developing security tools is to ensure that unauthorized users are not allowed into the system, and that authorized users are not too easily blocked from obtaining the data they have approved access to. The solution to this problem is to use currently available technology that has been tested either through the NH DES Exchange Network, or via the NH DHHS WRQS Project. If new security tools need to be developed for the NH EHDIN system, we will begin the process by erring towards a more restrictive system at first in order to ensure our data steward partners that the system will protect their interests.

6.5 Tools for Data Transport

6.5.1 Proprietary Network Tools for Data Transport

The EHDIN network will use a number of standardized tools, such as secure file transfer protocol (ftp), hypertext transfer protocol security (https), or a network file system (NFS), in order to move data between multiple agencies at the local, State and national levels. As described in the section below, the data will be moved via standard transfers that are appropriate to the users' needs.

6.5.1 Requirements for Data Transport

The EHDIN system will need to move data and resources between a number of different partners in a safe, effective, and rapid manner. In order to achieve transactions that are similar between partners (interoperable), all partners will need to agree on standard protocols for transport. A significant amount of public health data, and some environmental data, will be confidential and need to be protected during transport. In order to accomplish the data exchange, two different methods could be implemented, either non-automated or automated exchange.

Option 1: Non-Automated Data Exchange using a PHIN Client

A PHIN network client will be installed for the exchange of environmental monitoring data to Public Health. In order to accomplish the data exchange, two different methods could be implemented and both will have a criteria interface to help organize data retrieval.

Approach A: Data Consumer 'Pulls' from Data Provider

Figure 6.2 depicts a data exchange approach where the data consumer pulls data from the data provider. In this approach the data consumer uses a Node Client (or equivalent) to make a Query or Solicit Web Service request to the data provider. The data provider will respond to the Web Service request with the requested data in XML format. This approach would allow the data consumer to create a scheduled task to pull the data on an agreed upon frequency. In addition, the data consumer would be able to pull "on demand".

Approach B: Data Provider 'Pushes' to Data Consumer

Figure 6.3 below depicts a data exchange approach where the data provider pushes data to the data consumer. In this approach the data provider uses a Node Client (or equivalent) to make a Submit Web Service request to the data consumer. The data consumer will respond to the Web Service request based on the Submit handling method of the data consumer's Node. This approach would allow the data provider to push data to the data consumer when it is available.

Figure 6.2 Approach A: Data Consumer Pulls from Data Provider

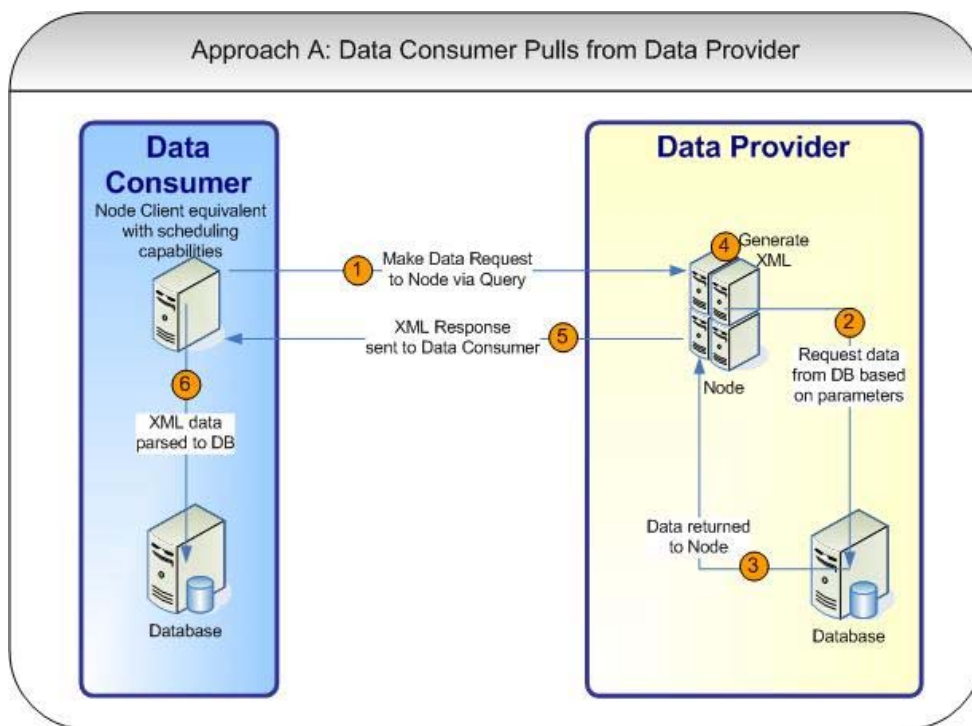
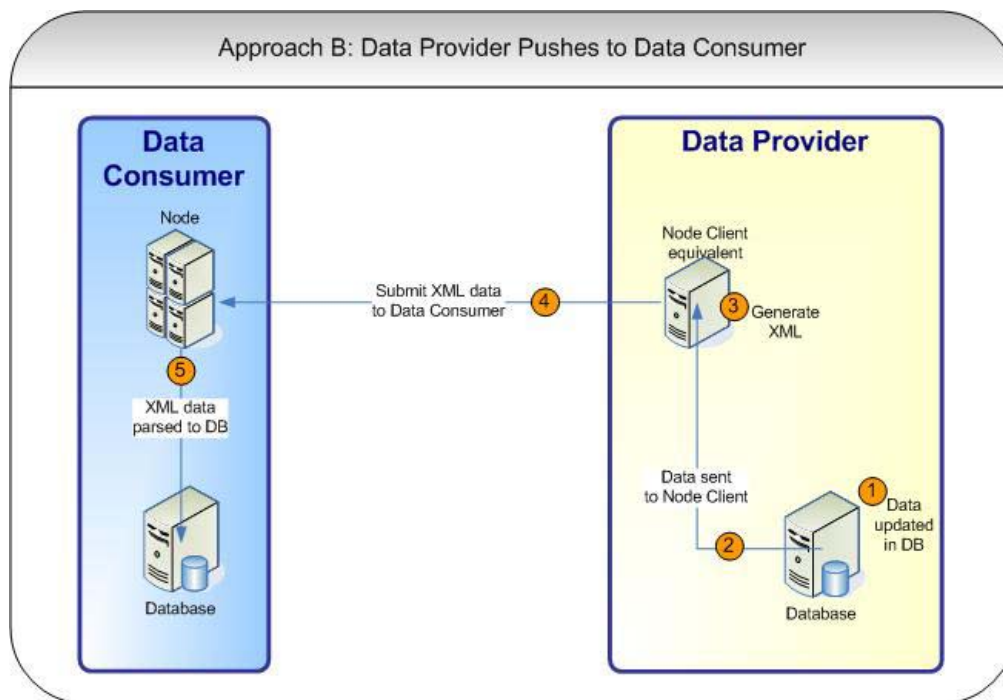


Figure 6.3 Approach B: Data Provider Pushes to Data Consumer



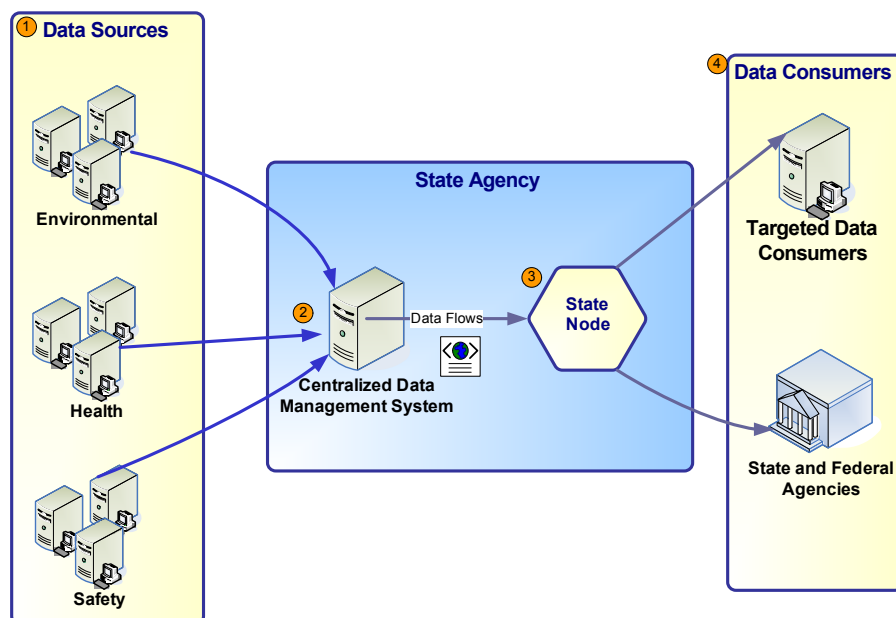
Option 2: Automated Data exchange for the PHIN Network between public health partners

The PHIN network node will have a function to securely and automatically send and receive information, as appropriate, between two computer systems, to achieve a “live” network for data exchange between partners in public health. In essence the PHIN network’s information between a computer system at one public health partner and a computer system at another public health partner will be continually updated.

This function should be implemented for the purpose of sending and receiving information between partners in public health including state and local public health agencies that run information systems. It should be used by laboratories participating in emergency preparedness and response activities and, at least in a sending mode, by participating clinical sites. The presentation of information to clinical sites and other participants in public health may be accomplished by public and secure web-based viewing via technologies identified in other included functions.

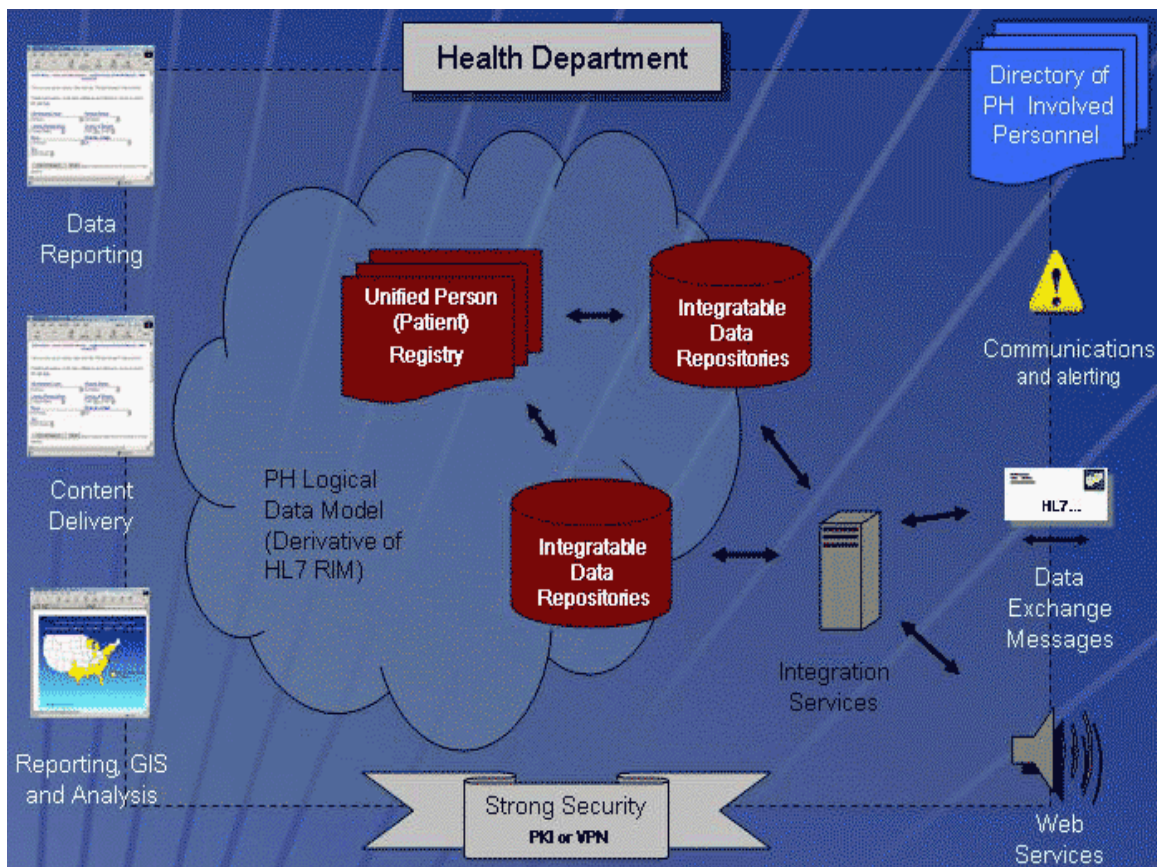
6.5.2 A Comparison between CDC PHIN Client and EPA Exchange Client

The PHIN and EPA Exchange Network have many elements in common, and some that are unique. The two systems do not appear to be incompatible. In regard to common elements, both the PHIN and EPA Exchange Network use “Push” and “Pull” methods to provide environmental or public health data to recipients. Both PHIN and Exchange Network will have criteria screens for data retrieval for the “Pull” method. In this way users can limit data returns. For example, if a customer only wanted gas station record from the Exchange Network then the customer could limit the search using a criteria window. In the push method the administrator of the PHIN and Exchange Network could schedule tasks to run at predefined intervals thereby providing data in a reliable process. In addition to logical structure, the PHIN and Exchange Network also have similar architecture (see figure 6.4 below). Both networks will have multi department data sources and share data among State agencies using a centralized data management system. Communication to other States or Federal government will be conducted via the host State’s node client. The host’s States node client will either have a task scheduled to transmit data to a partner or will have a node registry of acceptable partners for data exchange for data transmission.

Figure 6.4 Multiple Data Sources Linked into a State Node

In regard to the unique aspects of the two systems, it is true that while the system architecture for the PHIN and Exchange networks are similar they may not be compatible and sharing XML schemas could become difficult. The PHIN system, being the less developed system, will need to deliberately design (or use) some of the Exchange Network's XML schemas to make the two networks compatible and to save development time for the PHIN network. If the PHIN system uses some of the XML schemas from the Exchange Network then the code generation module used by the Exchange network can be reused if not directly called by the PHIN client. While some of the XML generation code and XML schemas may be interchangeable between PHIN and the Exchange Network the node clients will not be, because the nodes use different security systems. The PHIN will operate on a secure VPN or PKI network whereas the Exchange client node will secure itself using SSL (Secure sockets layer). See figure 6.5 below for more detail on the PHIN security.

Figure 6.5 Technical and Security Aspects of the PHIN-MS System



For a more detailed description of the elements described in the figure 6.8 above, see the following narrative of the PHIN-MS system.

- **VPN** is a private network that uses a public network (usually the internet) to connect remote sites or users together, instead of using dedicated connections between sites. VPN uses “Virtual” connections routed through the Internet from the company’s private network to the remote site or employee.
- **PKI** is a system of digital certificates, certificate authorities, and other registration authorities that verify and authenticate the validity of each party involved in an Internet transaction. PKIs are currently evolving and there is no single PKI, nor even a single agreed-upon standard for setting up a PKI.
- **SSL** is a protocol developed by Netscape for transmitting private documents via the Internet. SSL uses a cryptographic system that uses two keys to encrypt data. A public key known to everyone and a private or secret key known only to recipient of the message. Both Netscape Navigator and Internet Explorer support SSL.

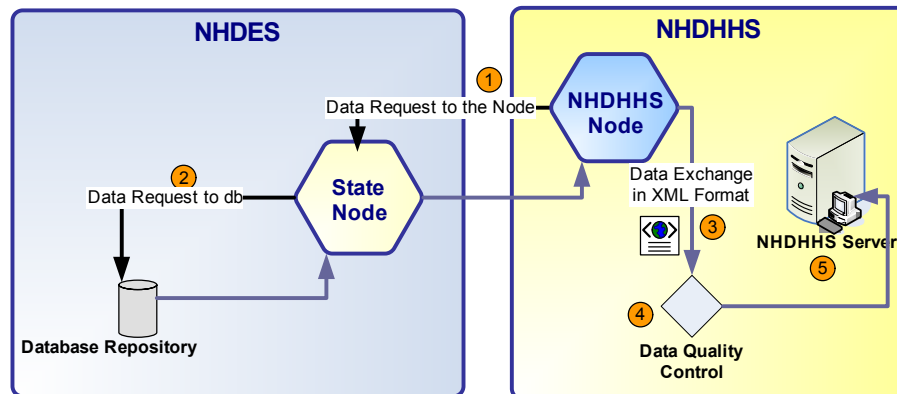
6.5.3 Desired Data Exchange Formats

Based on the desired functions outlined within the NH EHDIN system, there is a need to move data back-and-forth between the primary health and environmental agencies at the State level. In later phases, we plan to integrate in other data partners in the Departments of Transportation, Safety and Fish & Game. NH EHDIN proposes to retrieve most of the desired environmental data using NHDES' One-Stop website and then importing the data to Oracle software. The proposed method for implementing data exchange from NHDES to the NH EPHT system presented in Figure 6-6 below and discussed in the following steps:

1. **Data Request:** The NH EPHT Program will make a data request to NHDES database via the node. The NHDHHS may need to install a node client to be able to make data requests to the NHDES node. This node client will also be able to schedule the process of pulling data from the database repository of NHDES.
2. **Data Request Processing:** New data flows will be developed and plugged into the NHDES node based on the list of flows that are chosen for implementation. Anytime the NHDES node receives a data request, it will retrieve data from the database repository corresponding to that data flow and generate an XML Instance document. For the data exchange to be successful, the database should be accessible to the node.
3. **Data Response in XML:** The data will then be spit out in XML format based on the Homeland Security health and environmental data exchange XML schema that will be designed during the design phase of the project.
4. **NHDHHS Data Quality Control:** The received data will then be reviewed and the data quality will be evaluated through the use of data quality control procedures.
5. **Data Storage:** Once the data passes all quality measures, the data will be moved to production/development server depending upon the requirement for using the data.

Figure 6.6 Proposed Data Exchange from NH Environmental Agency to NH Health Agency

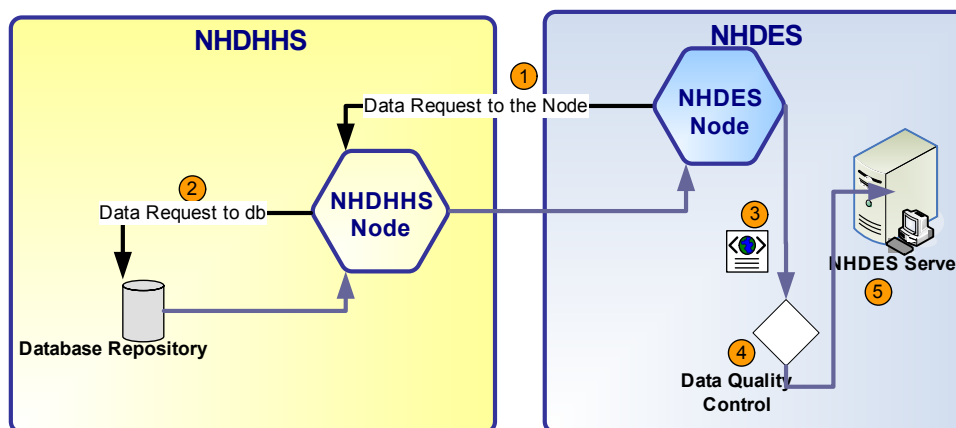
Proposed Data Exchange Process from NHDES to NHDHHS



Currently the NHDES does not have access to any of the datasets in NH DHHS. In order to receive this data, the proposed data exchange will take place via the steps described below:

Figure 6.7 Proposed Data Exchange from NH Health Agency to NH Environmental Agency

Proposed Data Exchange Process from NHDHHS to NHDES



1. **Data Request:** NHDES makes data request to the NH EPHT system via the node. If the NHDES node is not part of the system, NH EPHT Program will need to install a node application.
2. **Data Request Processing:** New data flows will be developed and plugged into the system node based on the list of flows that are chosen for implementation. Anytime the system node receives a data request, it will retrieve data from the database repository.

tory corresponding to that data flow and generate an XML Instance document. During this request processing, only those data elements will be pulled that do not contain any proprietary or confidential information. For the data exchange to be successful, the database should be accessible to the node.

3. **Data Response in XML:** The data will then be spit out in XML format based on the Homeland Security health and environmental data exchange XML schema that will be designed during the design phase of the project.
4. **NHDES Data Quality Control:** The received data will then be reviewed and the data quality will be evaluated through the use of data quality control procedures.
5. **Data Storage:** Once the data passes all quality measures, the data will be moved to production / development server depending upon the preferences of NH DES.

6.5.4 Concept of NH Flow

As indicated previously, data to support the pilot data exchange will come from two separate sources.

- NH DES staff currently maintains Oracle data tables containing up to date information about monitoring sites throughout the State. This is an ongoing EPA regulated program an established source of data.
- The second data source will reside on the NH DHHS PHIN-MS client. The hospital dataset will reside on this system. Periodic updates using a data upload process with authentication will periodically happen when a new dataset is available from NH DHHS.
- The NH DHHS PHIN client will fire off a message requesting a refresh of the air data. The Oracle database will fire off a stored procedure accepting to and from dates from the calling program the data will be saved in a set of tables.
- PHIN-MS will read from staging tables. The reply message will be based from these tables delivering updated information to the receiving PHIN-MS program.

This proposed Pilot Data Exchange process for 'Outdoor Air Quality & Asthma Exacerbation' will be accomplished through the following steps:

1. Ambient air quality monitoring information will be extracted from an NH DES air program database and formatted according to an agreed XML schema.
2. The resulting XML document will be passed through the NH DES Exchange Network Node Web services to the PHIN-MS Message Receiver service.
3. NH DHHS PHIN-MS will receive the message process the message then process the received information into their own database for analysis and linkage to other public health data sources on asthma.
4. NH DHHS may then make the data available to CDC in an agreed upon format.

The purpose of this document is to provide a business over view of NH EHDIN and also propose the technical specification for the Pilot Data Exchange. The materials presented

in this document were developed following multiple separate meetings conducted with a joint workgroup of technical staff from both NH DES and NH EPHT Program. The objective of the meetings were to build on the base understanding gained from this existing understanding of how the data flow & design of automated data flow using the Exchange Network Node at NH DES, XML for data transport.

A plug-in can be developed for the NH DES Node to interface with a DHHS PHIN-MS server. PHIN-MS is expecting a message in ebXML format. The plug-in on the NH DES Node would need to either run on a schedule or answer requests for data by running the extract from the source database, formatting with in an agreed upon schema, and wrapping it in ebXML appropriate to send to the PHIN-MS server.

The NH DES Node plug-in would utilize already existing Java code from NH DHHS to produce the ebXML file, and submit it to the PHIN-MS server using standard HTTP post and get methods as though it were a PHIN-MS client. The NH DES Node plug-in would have to have a mechanism to allow for administration and maintenance of PHIN-MS credentials. If scheduled execution is needed the NH DES Node would need to implement a scheduling mechanism that would execute the plug-in without human intervention. If scheduling is not needed, the request for the data would have to be initiated via standard EPA Exchange node primitive methods, such as solicit or query. The party that would initiate the process would have to have an EPA Exchange node client that could send the 'solicit' or query commands to the NH DES Node.

As indicated previously, data to support the pilot data exchange will come from two separate sources. Site information from the AQS Site Views the Air Quality Sites, including the following information. It also will be linking it with the Hospital Discharge data set.

6.5.4 New Hampshire's Tools for implementing Data Flows

NH DES Node - The hardware/software environment of the NH Node can be summarized as:

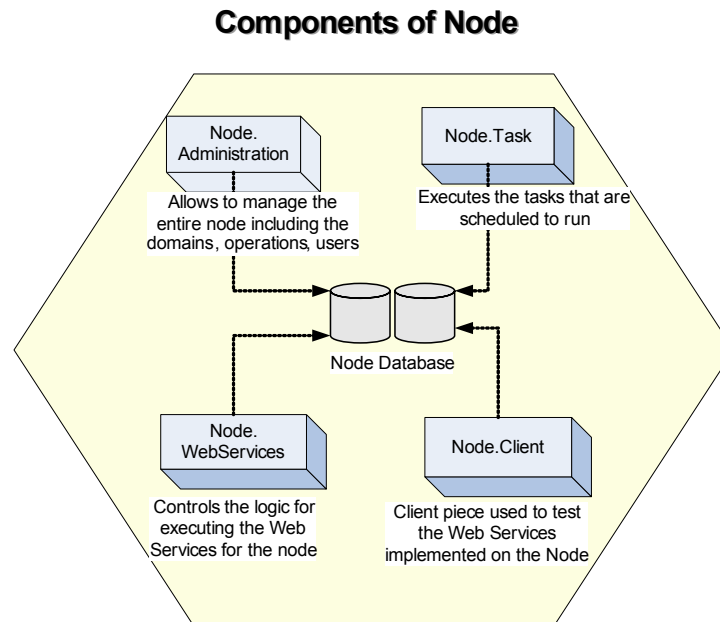
1. Programming Environment: .NET version 1.1
2. Database Platform: Oracle 8i and Oracle 7.3
3. Web Server: MS IIS
4. Application Server: BizTalk 2004

As outlined in Figure 6.8 below, the Node is comprised of 4 main components:

1. **Node.WebServices:** Acts as an engine that controls the logic for executing the Web Services on the Node.
2. **Node.Task:** Provides the capability to execute tasks that have been scheduled to run. These tasks can include the operations scheduled for the data flow. The tasks that are scheduled to run typically involve the invocation of Web Services on EPA's Node.

3. **Node.Administration:** A graphical user interface that allows administrators to configure the Node and manage data flows. Node.Administration serves as an interface to both Node.WebServices and Node.Task.
4. **Node.Test:** A client interface that provides the functionality to test / invoke the Web Services on the Node. This application can also serve as a Node client for those users who do not have access to the Node.Administration application.

Figure 6-8. Components of the NH Data Exchange Node



The flow administrator of the node can add a new flow by making necessary changes to the Node configurations and creating a stored procedure. The (chronological) steps to be followed for adding a new data flow are listed below:

- Create a new stored procedure to control the logic of pulling fields from one database and populating into another, then:
- Create map from database to schema file
- Create XML file from data
- Use BizTalk Mapper to map data to schema
- Create XSLT style sheet (if necessary)
- Update the <ServicesSetting> section of the system.config file
- Navigate the System Configuration section of Node.Administration and open the System.Config file
- Modify <ServicesSetting> with appropriate name and parameters
- Click 'Validate' and 'Update' to save changes

- Update the <dllsetting> of the system.config file
- Navigate the System Configuration section of Node.Administration and open the System.Config file
- Modify <dllsetting> with appropriate name and location
- Click 'Validate and 'Update' to save changes
- Create new channel for data transformation making use of available wizard

6.5.5 Current Data Flows

So far, NHDES has implemented two data-flows on the Node:

Facility Registry System (FRS):

EPA's Facility Registry System is a data warehouse of facility-related information that is submitted by state agency to the EPA. NHDES implemented the outbound Facility data flow to submit facility identification data from various locations across NH. The information will include required reporting of releases, storage of hazardous materials, and identification of hazardous waste sites (RCRA Handler).

Beach Inspections & Closure:

Beaches in an outbound data flow to EPA. The implementation of this flow has allowed NHDES to submit electronically their annual beach water quality and swimming advisory data to the EPA, making use of EPA's XML schema.

The NHDES is also anticipating the implementation of public drinking water quality data by the end of February 2006.

6.5.6 Requirements for Data Flow Integration/Linking

The data exchange solution for health and environmental data integration is based on the EPA Exchange Network approach of transporting data through the use of a Node. The data exchange solution can be summarized in the following steps:

1) Procure Node, Required Hardware, Software, and Network

NHDES and NHDHHS will need to assess whether or not their current hardware is sufficient to support a production Network Node (if one is not currently installed). They will need a machine to support the Node server and a machine to support their database systems.

Required software for NHDES includes an Operating System, a Web Server, Security Software (SSL Certificate), and Web Development Tools. The agencies will also need to ensure that their Node is open to the Internet via a high-speed connection.

NHDES and NHDHHS will need to open ports to the database servers that host databases that will be used in the data flow.

NHDES currently has a fully functional Node and the hardware and software infrastructure to be able to meet all the requirements for implementation of data flows.

2) Identify the Data Sources and Data Consumers

This document has identified many potential data sources. It will be necessary to prioritize the data sources using on the following areas:

Importance of the Data Source to Protecting the Public - Will using this data source provide extremely important data that can be used to help prepare for and respond to homeland security emergencies? Will using this data source help improve the overall safety / health of the citizens of New Hampshire?

Return on Investment: By automating data exchange, which data sources will provide the largest return on investment including resource savings?

3) Create/Develop XML Schema

The Exchange Network Nodes exchange data using Web Services and XML technology. It is therefore necessary to develop an XML Schema to define the data health and environmental data exchange. This schema may include existing Exchange Network Schemas, such as the Facility Registry System (FRS) schema, the Electronic Drinking Water Report Schema (e-DWR) etc. The health and environmental data schema must comply with the current Exchange Network standards.

Perform Data Mapping

Data elements from the data sources identified for implementation will be mapped to the XML schema. The data mapping will include all business requirements and data translations / transformations that are needed.

Query Data from the Data Sources

Data will be queried from the data sources through the use of stored procedures or Query / Solicit Web Service method. The data will be used to generate an XML Instance document based on the health and environmental data exchange schema.

Integrate Flows into the Core Node Functionality

Once the data is mapped and the data exchange query is coded, it will need to be tied in with the core node functionality to ensure that the data can be exchange using the Node.

6.5.7 Challenges and Solutions for Data Transport

The primary challenges to moving data include the labor involved with developing the programs to run the system and solving (debugging) the system during the pilot test phase. In addition, ebXML format requires extensive and lengthy certification, and can be problematic to implement. Labor would also be high for using NH DHHS (or PHIN-MS) code within the EPA Exchange Node and would require maintenance and update synchronization. This approach could be dependant on added functionality to the DES NEIEN Node implementation to facilitate scheduling. On the positive side, the methodology in this ap-

proach may be more applicable in a broad sense, for other agencies, states, or partners. Additionally, NH DHHS has already developed JAVA code that could be utilized in the NEIEN Node plug in.

6.6 Tools for Data Analysis and Transformation

The following section describes the technical tools for data analysis and transformation, including a review of the data warehouse, data brokering, and geographic information systems.

6.6.1 System Requirements for Data Transformation

In New Hampshire, we envision a wide variety of data being shared on the Network in many different formats. In some cases, raw data will be exchanged between partners while in others, interpreted and transformed data will be exchanged. The NH EHDIN system will need a mechanism that will allow them to store their data in formats that enable transformation and analysis. Data brokerage solutions can be used to transform the data into a format that is required for a specific purpose where it is not possible to enforce a degree of standardization on the data. This transformation may be conducted either by the data owner or by the data recipient and will depend on the details of the Trading Partner Agreement between the two parties. As discussed in the previous section on Network functions, it is likely that we will use PHIN-MS to broker the data exchange process. Other options outlined in the NNIP are presented below.

6.6.2 Technical Approaches to Data Transformation

Data Warehouse

A data warehouse is, primarily, a record of an enterprise's past transactional and operational information, stored in a database designed to favor efficient data analysis and reporting. Data warehousing is not meant for data that are currently being collected and updated. Data warehouses often hold large amounts of information that are sometimes subdivided into smaller logical units called dependent data marts. Before data is loaded into a warehouse, it undergoes Extraction, Transformation and Loading (ETL).

Extraction: The first part of an ETL process is to extract and consolidate data from different source systems. Each separate system may use a different data organization / format. Common data source formats are relational databases, and flat files, but other source formats exist. Extraction converts the data into records and fields.

Transformation: The transformation phase applies a series of rules or functions to the extracted data to derive the data to be loaded. Some data sources will require very little manipulation of data. However, in other cases any combination of the following transformations types may be required:

- › Selecting only certain fields to load.
- › Translate coded values.
- › Joining data from multiple sources (e.g. lookup, merge, etc).
- › Summarizing multiple rows of data.

Loading: The load phase loads the data into the data warehouse. Depending on the requirements of the organization, this process ranges widely. Some data warehouses merely overwrite old information with new data. More complex systems can maintain a history and audit trail of all changes to the data.

Data Brokering

Data Brokering is used when relatively large volumes of data need to be transformed so that they can be used in a different way or by a different application. There are a number of software solutions that allow the transformation of data from one format to another and allow the automated routing and manipulation of data using predefined logic. These methods are particularly valuable in situations where it is not possible to enforce a data standard or where data collected for a particular purpose needs to be modified for use for another purpose. These methods are also useful when the two entities exchanging data use different data standards. The software solution usually allows the user to map the elements of the standards against each other and translate data between the standards. A data brokering system can be setup for one-off data exchanges or when data with the same structure need to be modified frequently.

Geographic Information Systems

A geographic information system (GIS) is a system for creating and managing spatial data and associated attributes. In the strictest sense, it is a computer system capable of integrating, storing, editing, analyzing, and displaying geographically-referenced information. In a more generic sense, GIS is a "smart map" tool that allows users to create interactive queries (user created searches), analyze the spatial information, and edit data.

For our current EHDIN project scope, our plans to transform datasets via linkage has been limited to one environmental health issues based on the best available data. However, the underlying infrastructure to support this and all future data sets will need to be put in place prior to completion of our pilot project.

- Secure Web servers using IIS and SSL
- Secure Web site with mandatory registration process
- Secure Web Browsing with Authentication

NH has used similar secure measures in the EPA CDX Exchange network, we base the above security off the CROMERR rule that has been put in place by EPA we will follow the same outline for this project. We chose to break our project down based on identified stakeholder/clients and their needs and realistic data to informational transformations.

1. Internal Super User- ability to query various datasets, filtered by their specifications, and download as a MS Excel, MS Access or delimited text file to better analyze the information offline. This would be unique and only be allowed based off security that will be placed on the Health Tracking WEB site. These people will gain authorization to the system by going through the registration process. Each time the wish to view the information located on the Health Tracking WEB site the will need to re-authenticated.

2. Internal Limited User – limited access to the data, able to view aggregate information

3. External Clients – users outside the State that have no passwords (no authentication)

4. Authentic Clients – users outside the State that have passwords (authentication)

Provided below is a further description of the clients who will transform data:

- 1) These clients will gain access to the system via login pin password combination. This process is in-place within DES and will be duplicated for this new application. With minor adaptation will be put in place for the EPHTN network to be used with this application. EPA policy makers have reviewed the registration/authentication process currently being used in DES.
- 2) Via the State of NH we can authorize users based on their windows security, which is currently in place statewide.
- 3) External authenticated users will essentially be accepted into the system with the same steps as a State authenticated user. They will have a combination of Login pin password identification.

Other data analysis and transformation capabilities that might be useful to users include the following: reports calculating incidence or prevalence rates, ability to calculate confidence intervals, data aggregation layers (years, town, HSA, county, zip code, all females etc). Some mapping capabilities which would be useful include some pre-defined maps with the ability to add/remove labels, landmarks, dynamically change geographic or time aggregations, colors and variable groupings, the ability to dynamically select zones of interest. Examples of some of these capabilities can be seen at the US Census website (www.factfinder.census.gov), the NH Birth Query tool (<http://www.dhhs.state.nh.us/DHHS/HSDM/Birth+Data/Birth+Query+Tool/default.htm>) and ATSDR (<http://www.atsdr.cdc.gov/hazdat.html>).

6.6.3 Challenges and Solutions for Data Transformation

Once data has been transported through the system, the challenge will be to transform the data into a format that is most useful to our clients. One of the main challenges in transforming data is to include the level of detail required by users while protecting data security and personally identifiable information (PII). In NH, this challenge has been solved in other areas by de-identifying or blocking data that identifies small cases of illnesses in geographic locations that can be easily located. In addition, partners exchanging data need to agree in advance who is responsible for transforming and how it will be accomplished.

6.7 Tools for Collaboration Mechanisms

The following section provides a brief overview of the technical tools to facilitate the collaboration between individuals and organizations. Specific collaboration tools that can be integrated into the NH EHDIN system include directory services, message boards, shared workspaces, and social networking.

6.7.1 System Requirements

The NH EHDIN system will also need to create tools to improve and facilitate cooperation between organizations and individuals. Although a system can be successful by providing

a large amount of data in useful formats, users of varying abilities and interests will want to work with others who are familiar with the NH EHDIN system. In order to find and communicate with other users, a number of tools can be utilized.

6.7.2 Technical Approaches to Collaboration Tools

The NH EPHT Program is already using a form of shared NH DHHS workspace called E-Studio (<http://www.same-page.com/studio/>) that allows users to view documents that can be edited and updated in a common space. This eliminates the need to ship multiple versions of a document via email. The system also includes a message board and other discussion options for sharing information. In regard to social networking, NH EPHT provides venues for meeting other State tracking partners via the Advisory Board, the Environmental Epi Team, and at events such as the Environment and Health 2005 conference held in September.

6.7.3 Challenges and Solutions for Collaboration Tools

One of the main challenges to the development of tools for working with other Tracking partners is the expanding number of meeting forums and web-boards that exist. Even a well-designed collaboration tool may not be used if it is too similar to others tools, or is perceived as a burden of more information as opposed to an opportunity for better communication. Solutions to the 'information overload' dilemma include better design and marketing of tools to the appropriate target audience. In addition, working within existing 'popular' collaboration tools and meetings is another way to benefit from the success of other programs.

7.0 Network Coordination

7.1 Background and Overview

Like all networks, NH EHDIN is a collaboration of individual functions and needs of various systems, technologies, processes, and people. Interconnecting these disparate entities to form one interoperable enterprise with a shared goal cannot be accomplished by an outside force—it must come from within. As mentioned in the National NIP, networks imply inter-dependencies; the success of the whole is dependent on the cooperation of each.

From the beginning, the design of NH EHDIN and its planned implementation has been a coordinated effort among agencies and individuals--from the smallest program, (NH EPHT) to the largest, (NH DHHS) and with many in between (NH DES, NH OIT, NH EPHT Advisory Council, NH Environmental Epidemiologist Team). The coordination of these groups, with others, will continue as we move toward implementation.

Coordinating NH EHDIN from a technological standpoint will primarily involve the efforts of NH OIT, NH DES and NH DHHS, with the NH EPHT Program providing facilitation, funding, motivation and manpower. At its essence, NH EHDIN will operate within the guidelines and structures established by PHIN, as well as within the operations of the EPA Exchange Network, where appropriate (see section 4.2.3).

7.2 Network Coordination Needs

As NH EHDIN moves from planning to implementation, decisions regarding content, participants, functions, processes, resources, and operating procedures, as outlined in the Network plan and those developed later, will need to be made. In its Implementation Development Guidelines, the Standards and Network Development Workgroup identified the following as coordination needs in support of NEPHTN implementation:

- Identify/clarify authorities¹ and areas for decision-making
- Identify/clarify roles of partners (e.g., other federal agencies, NGOs, non-grantees)
- Identify approaches for addressing “policy” decisions for Network development, including the following:
 - Overall NEPHTN goals
 - Users
 - Publishing data on the NEPHTN – quality, security, metadata
 - Accessing data – suppression/aggregation guidelines, role-based access, security
 - Populating registries – quality and security
 - Licensing tools and data

¹ CDC as the granting agency has specific authorities in the issuance and oversight of grants, agreements, and contracts. The network development decisions would focus on the partnership in network development, evolution, and sustainability.

- Establish and support appropriate advisory committees and workgroups (e.g., NASG, SND, PMO, other)
- Identify/adopt technology standards recommended by committees and workgroups
- Clarify and agree to NEPHTN content
- Address NEPHTN funding needs
- Establish operating policies and procedures for the NEPHTN
- Establish appropriate communication mechanisms to keep all parties informed
- Discuss relationship with grantee decisions

7.3 Coordination of Human Resources

As NH EHDIN progresses toward implementation, we expect to have similar network coordination needs as mentioned in the section above. To address those needs the Sand's Principles document mentions forming a "National Coordinating Body." To that aim, we plan to form the NH EHDIN Advisory Group that will help us make decisions regarding NH EHDIN design and implementation.

The NH EHDIN Advisory Group will consist of a small number of key stakeholders and potential users with expertise in network development, interoperability, and network coordination. Our project team will consist of members from NH DHHS, NH DES, and NH OIT. We have group members from NH DES with a combined nine years' work experience in the Exchange Network. They were involved in Node Alpha project; Node Beta project and Node 1.0 project these early projects contributed to the success of the Exchange Network. The NH EHDIN Advisory Group will focus on the continued development of the Network design and perform as evaluators of the usefulness and effectiveness of NH EHDIN throughout the implementation process.

Below is a sample list of system stakeholders who are expected to be included in the NH EHDIN Advisory Group.

Name	Stakeholder Name	Planning Responsibilities	Pilot Responsibilities
NH Office of Information Technology	Daniel Burleigh, Chris Simmers	Provides technical assistance to the design of the system to exchange health and environmental data	Develop and implement data exchange protocol
NH Dept. of Health and Human Services	Matthew Cahillane	Provide vision and project requirements	Serves as a primary data owner and steward of health-related data systems.
NH Dept. of Health and Human Services	Laura Holmes	Provide project planning and evaluation assistance	Direct project tasks; implement process and outcome evaluation

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NH DHHS	David Swenson, data steward	Provide requirements for Cancer Registry data elements	Supports piloting of data exchange
NH Dept. of Environmental Services	Rick Rumba, Vincent Perelli, & data stewards	Provide requirements for pollution data elements	Supports piloting of data exchange
NH EHTP Advisory Council	Rep. Barbara French	Provides guidance on the user needs and design of the NH EHT System	Review and approve implementation plan
NH DHHS Environmental Epi Team	Jose Monitor, NH State Epidemiologist	Provides technical & epidemiological support for the design of the NH EHT System	Maintains access to data sources in public health with privacy concerns
City Health Dept. Manchester, NH	Gregory Gauthier, IT Support	Provides perspective on local data collection and user needs	May provide data to be used in the system
CCNTR Local EPHT Project, Franklin, NH	Jeanne Gallo-way, or Richard Silver berg	Provides perspective on local data collection and user needs	May provide data to be used in the system
University of NH. Durham, NH	Cameron Wake, INHALE Project	Provide advice on the best quality data sources	Collects data and provide results for air quality, pyrometer, and health care costs

7.3.1 Challenges, approaches, and solutions

As with all efforts of coordination and collaboration, differences will arise among cooperating members. It would be unusual for those not to occur during the implementation of NH EHDIN, especially since NH EHDIN will function across agencies, across levels of government, and across disciplines. Already, we have experienced the challenge of translating the different “languages” spoken among employees of OIT, DES, and DHHS. However, we’re certain that the investment our NH EHTP Advisory Council and Environmental Epidemiologist Team has already made in developing a NH environmental public health tracking system will fuel continued cooperation.

Within the NH EHDIN Advisory Group, we foresee a challenge in shifting the focus of a number and variety of individuals from their specific program or agency mission to that of environmental public health tracking, however, within New Hampshire, there is a long-standing level of cooperation between state agencies and programs, between local and state government, and among the different disciplines that play a critical role in environmental public health. We expect this culture of cooperation, which has served us so well for the past three years, to continue throughout the life of NH EHDIN.

Our biggest challenge to networking existing data systems IT-wise, will most likely occur during the data standardization process. Due to the lack of data standards at both the state and national level, data stored with the silos of systems in NH DES and NH DHHS conform to program-specific needs versus any kind of nationally or state recognized standard. NH

DES is far more advanced in standardizing their data than NH DHHS. How we approach standardizing data, either upon input into NH EHDIN or after receipt, will most likely be determined by the technological capabilities and political will of individual agencies and the NH EPHT Program.

To our advantage, we have in place a human network of supportive officials from NH DHHS, NH DES and OIT that have placed the implementation of NH EHDIN as a priority. This support system will be instrumental in overcoming the technological barriers to networking silos of data systems. Their influence and motivation will be a catalyst toward cooperation among these agencies and in using and modifying existing IT technology within these agencies for a shared purpose.

7.4 Coordination of Shared Goals & Decisions (Taps, Mouse, etc.)

7.4.1 Written Agreements

Traditionally, exchanges of data between NH state agencies and programs are governed by the details of a Trading Partner Agreement (TPA), Memorandum of Understanding (MOU), or data request. In the implementation of NH EHDIN, we will develop Taps and/or Mouse with NH DES and NH DHHS that will serve as a formal agreement on the use and distribution of data within NH EHDIN. The TPA will address when de-identified raw data and aggregated data can be exchanged, how it will be used by the Network and its users, as well as the rules for data that has been properly quality assured and/or that has limited quality assurance.

7.4.2 Challenges, approaches, and solutions

The major challenge we foresee to developing Taps and Mouse for data access and exchange involves HIPPA and other requirements restricting access to personally identifiable information (PII). The issue of PII is of particular concern to providers of health data and of mild concern to providers of environmental data, with the exception of home radon test data and private well water test data. Presently, we have acquired NH DES radon data via a data request and are in the process of developing a data request for private well water data from the NH DES lab. However, use of this data is limited specifically to the NH EPHT Program.

In general, we foresee the need to develop Taps or Mouse for the data we intend to incorporate into NH EHDIN that includes explicit language detailing the user authorization process, the levels of access to authorized users and the security measures that will be put in place to prevent unauthorized access to PII.

8. Implementation Pathways

8.1 Background and Overview

In the early phases of Network evolution, there is always a need to keep our options open for the design and implementation of the system. In contrast to data Networks that are already established, the NH EHDIN will need to remain flexible in terms of choosing our content, technology, and collaboration mechanisms. Water always follows the path of least resistance, and we will likely do the same.

The design and implementation of NH EHDIN has been, and will continue to be, a collaborative effort among the NH DHHS, NH Division of Public Health, NH DES, and NH OIT. Support and cooperation from these agencies was initiated at the inception of the NH EPHT Program and continues to grow as the value of NH EHDIN and its capabilities become apparent. Currently, both NH DHHS and NH DES have a need to standardize and integrate the various silos of data that exists among these agencies. This has become a major goal for both agencies for a number of reasons, including the improvement of health outcomes among NH publics, the control and reduction of environmental hazards, and increasing the capacity to respond to emergency situations. In short, NH EHDIN has the capacity to meet the data analysis needs of various agencies within NH for a variety of purposes.

In order to develop an implementation plan for the creation of NH EHDIN, the NH EPHT Program staff, (which includes three employees from the NH DES), partnered with staff from the NH OIT and NH DES, to identify the most feasible implementation pathway for NH EHDIN. As a result, it was determined that NH EHDIN would incorporate the technology currently in use that administers the NH DES One-Stop Program of linked environmental data, <http://www.des.state.nh.us/OneStop/>, and the in-state network (NH Intranet), purchase a server for NH EHDIN that would communicate with these systems using PHIN MS to make data available to users.

The following steps outline the proposed technological implementation pathway for NH EHDIN.

1. Identify sources of data: NH DES and NH DHHS
2. Purchase equipment for NH EHDIN infrastructure (server)
3. Configure the server with software
4. Put the server on the in-state network
5. Load software – IRS web server configured, IIS (Microsoft)
6. Load PHINMS on DES server and NH EHDIN
7. Make the two PHIN systems talk and exchange data
8. NH EHDIN would request data from DES
9. DHHS data would log onto NH EHDIN and upload the data into NH EHDIN
10. Data would reside on NH EHDIN (XML data)
11. Webserver would point to NH EHDIN enabling clients to log on and retrieve data

12. Webservice would be written in Microsoft.net

Implementation pathways for network coordination involve the interaction of existing systems within NH DES and NH DHHS using PHIN MS as the data transport mechanism. Implementation pathways for the development of content within NH EHDIN have been guided by the assessments that informed our identification of our priority indicators, in conjunction with the results of our Database Inventory performed in 2005. Initially, for reasons of accessibility, data for the alpha test of NH EHDIN will be the NH DES public drinking water data and the dental caries data available from NH Medicaid. Data for the beta test will include the NH DES air monitoring data, hospital emergency department data, hospital inpatient and outpatient data, radon test result data, and NH State Cancer Registry data.

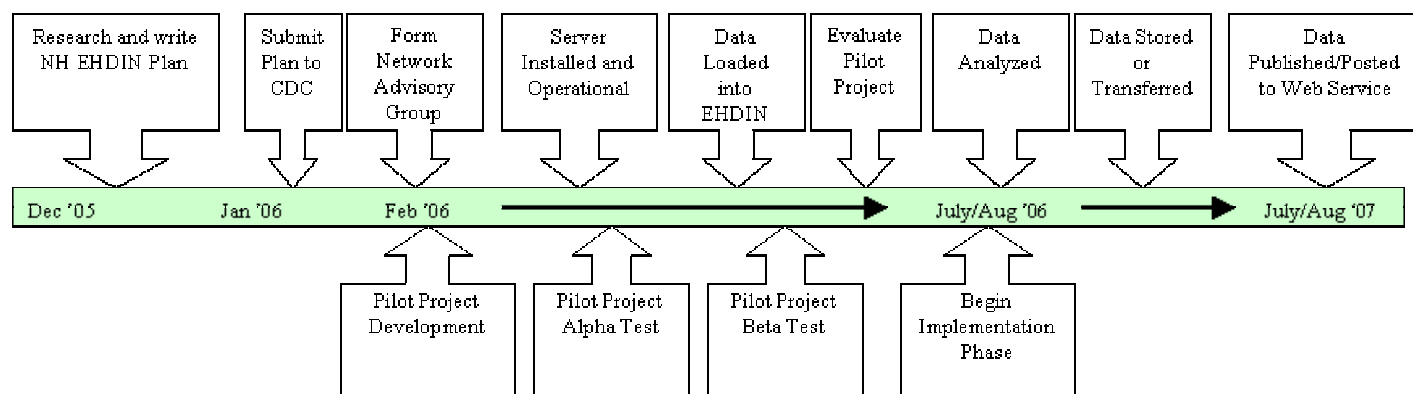
For all future datasets, NH EHDIN will enable pre-qualified users to upload standardized data into the network for storage, integration and manipulation in a secure environment. As well, NH EHDIN will enable data to be accessed by pre-qualified users in a secure environment, “pull” data from sources linked to NH EHDIN, and “push” data to particular users on a regular basis.

In order to design and construct NH EHDIN to be as beneficial as possible to our stakeholders, our implementation pathways for technology, content and coordination will be reviewed and evaluated by a Network Advisory Group made up of stakeholders and potential users from NH DHHS, NH DES, and NH OIT. This group will guide the design and implementation of NH EHDIN and serve as alpha and beta testers.

8.2 Implementation Timeline

The general activities involved in the implementation of NH EHDIN are illustrated below. The first stage of activities in early 2006 includes the installation of hardware and software, the initiation of our pilot project, and the population of the system with data. The second stage of activities in mid 2006 involves actual implementation of NH EHDIN with the ability to analyze, store, transfer data, leading to data being published on NH EHDIN in summer 2007. Throughout this timeline, the Network Advisory Group and select users will evaluate NH EHDIN for effectiveness and usability.

Figure 8.2 NH EHDIN Implementation Timeline



8.2.1 Challenges, approaches, and solutions

Challenges to identifying implementation pathways, and a timeline for such, stem from the complicated nature of developing a system that will, for the first time, integrate automated environmental and health data, make the data available to a variety of users in a variety of ways, and connect the system into a national network. Models and templates to guide such a networked system do not exist and those used for the development of existing systems, such as communicable disease surveillance, NEDSS, and the EPA Exchange Network, have shown some value but are of limited use. Given that, NH EPHT Program will rely on the collaborative environmental already existing among the Program and the other agencies involved in NH EHDIN's implementation, to provide evaluation and feedback regarding the most effective and efficient implementation pathways for Network implementation.

Due to the complex technical and human requirements of NH EHDIN, we expect the path to implementation to have its share of hills and valleys, and progress to be made in fits and starts. We expect the inevitable technical complications to arise when a new system is developed and incorporated into existing systems. And we also expect there to be difficulties in meeting the increased demand on human resources required for implementing NH EHDIN. In addition, selecting the most viable implementation pathway for the functions we will require NH EHDIN to perform will involve collaboration between IT people, EPHT people, and potential users. The 'meeting of the minds' that will be required throughout the planning and implementation of NH EHDIN may become the greatest challenge of them all. However, it is to our advantage that we experienced a great deal of success in joining the forces of the NH EPHT Program, NH DHHS, NH DES, and NH OIT to complete the current NH EHDIN Plan in such a short period of time. We expect this success to continue throughout NH EHDIN's pilot stage and full implementation stage. As each agency recognizes NH EHDIN's value as a partner in the development of their public health programs and policies, we expect the support necessary for timely and effective implementation to increase and for potential barriers and challenges to be minimized, if not eliminated.

9.0 Network Plan Management

9.1 Background and Overview

The development of the NH EHDIN implementation plan has been, and will continue to be, a collaborative endeavor involving the NH EPHT Program, NH DHHS, NH DPHS, NH DES, NH OIT, and other Program stakeholders. The plan will guide the activities and efforts of these agencies in regard to NH EHDIN as we build, review and refine the system. With the assistance of our Network Advisory Group, the management of our plan will continue in this same vein of cooperation and collaboration, and will include ongoing evaluation by program staff and key stakeholders in order to assure NH EHDIN's effectiveness and usefulness.

9.2 Requirements for Network Plan Management

9.2.1 Network Plan Evaluation

As a system envisioned as a web service to our publics, NH EHDIN will be expected to be user-friendly, efficient, and effective to a variety of users, as well as remain current and relevant to their needs. Therefore, it is imperative that our Network Implementation Plan reflects these requirements. To do so, our Plan will need to be monitored and evaluated by a subset of users, such as our Network Advisory Group, on a regular basis in order to provide recommendations for improvements.

The method for evaluating the plan will be based on National EPHT models for process evaluation, as well as other relevant evaluation tools such as the CDC Evaluation Framework, [cdc eval framework.htm](#), and the W.K. Kellogg Foundation's Logic Model Development Guide, [Logic Model.pdf](#).

Initially, we expect to present our NH EHDIN Implementation Plan Version 1.0 to our Network Advisory Group in early February 2006 for overall review. It will be imperative at that point that the group identify performance goals and measures to help guide us in the creation of a Network that meets their needs.

Our initial focus with the Network Advisory Group will be on the pilot phase and its successful implementation, as it is during the pilot stage of NH EHDIN implementation where we expect to have the most need for plan evaluation and modification, and where we expect most of the "bugs" to be identified and corrected. Once the pilot phase is complete and a process evaluation performed, we will evaluate the plan as it relates to the implementation phase. (See Section 8.2)

Recommendations resulting from these evaluations will be incorporated into the plan and be reflected in modifications to the design and implementation of NH EHDIN. With the understanding that full implementation of NH EHDIN may take more than a year to complete, we expect our plan to be evaluated by the Network Advisory Group on a monthly or bi-monthly basis during the pilot phase and perhaps quarterly as recommendations for change become less numerous, as we expect will happen during the full implementation phase.

Upon successful implementation of NH EHDIN, the Network Implementation Plan will become the NH EHDIN User's Manual and provide a basis for other documentation.

Steps for Network Plan Management:

Step One – Identify a Network Advisory Group
Step Two – Develop performance measures/goals for user requirements
Step Three – Evaluate Network Implementation Plan for Pilot Phase
Step Four – Incorporate recommendations
Step Five – Evaluate Pilot Phase
Step Six – Incorporate recommendations
Step Seven - Evaluate Plan for Implementation Phase
Step Eight – Evaluate Implementation Phase
Step Nine – Incorporate recommendations
Step Ten – Development of the NH EHDIN User’s Manual and other documentation

9.2.2 Challenges, approaches, and solutions

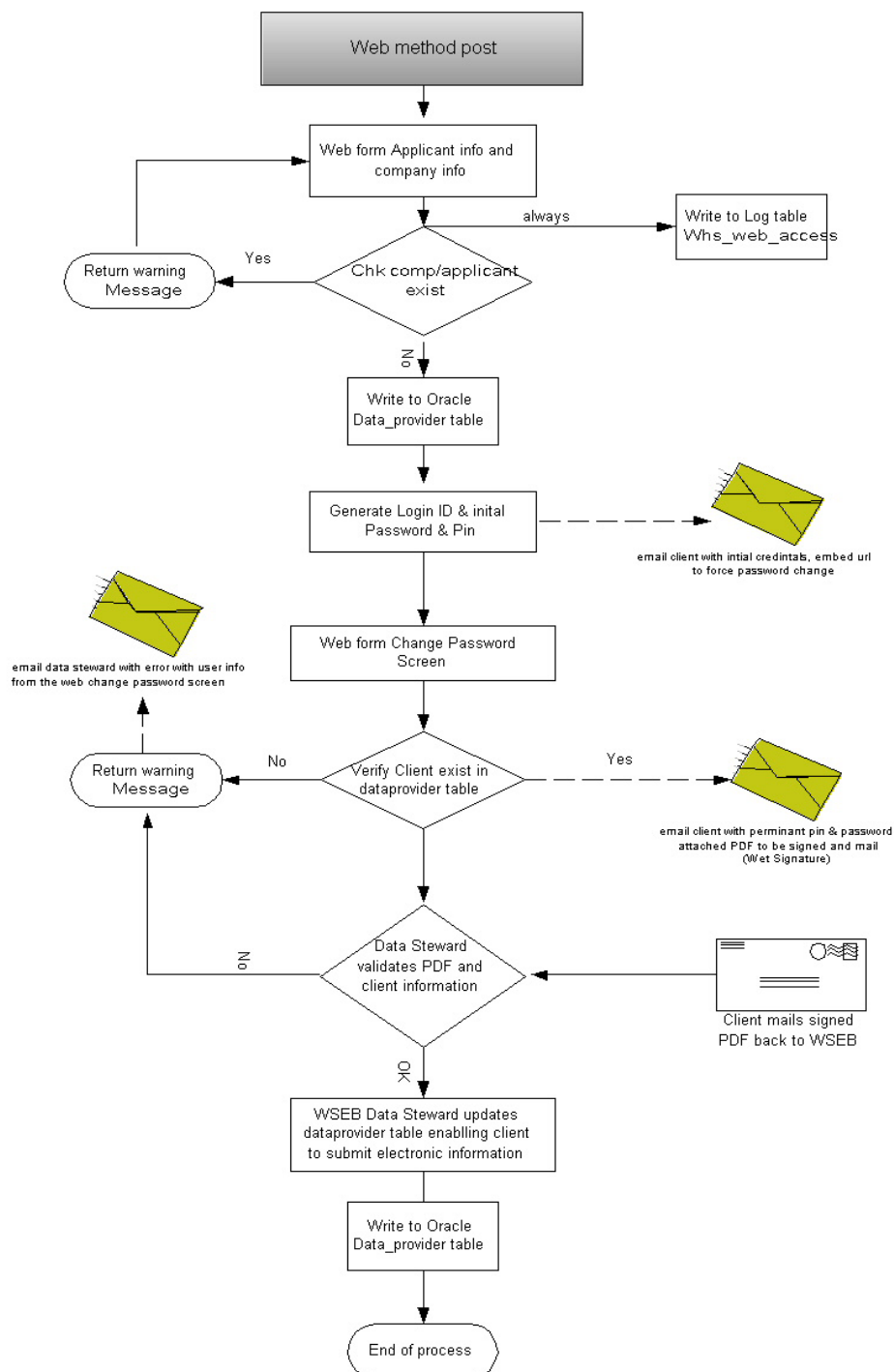
Challenges to managing our Network Plan will most likely consist of the practicalities involved in gathering together a group of individuals from various locations to meet on a regular basis. Judging from our experiences with the NH EPHT Program Advisory Council, creating an incentive that is appealing enough to elicit the necessary participation is difficult, especially for the caliber of professional that we would need for our Network Advisory Group. Professionals with the necessary expertise are usually already overbooked and overloaded with work. The successes we can claim with the Advisory Council we found to be due to the following: providing information that is relevant to specific aspects of their work or interests; providing an opportunity for hands-on involvement or breakout sessions; and providing necessities such as keeping the meeting brief, offering a convenient location and time, and providing exciting food.

We are hoping that the anticipation created by the Advisory Council meetings prior to this point, and the opportunity to see all their preliminary efforts put into an actual system design, will be provoking enough for attendance to be more than adequate. Maintaining their interest and keeping the momentum going over the course of a year or more will be the biggest challenge. Devising creative solutions to ongoing evaluation of the plan and Network implementation will probably be required. Solutions such as web-based evaluations, surveys, and the use of subgroups, such as User Acceptance Testing and Joint Application Development groups, should be investigated.

Appendices

Appendix A: NH EHDIN Registration Process – Client Registration

Registration Process



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The registration process will initiate with the following screen.

The client completes the required information and presses submit.

The screenshot shows a web browser window titled "Data Provider Registration Form - Microsoft Internet Explorer". The address bar displays "http://www.des.state.nh.us/asp/dataprovider/dataprovider-registration.asp". The page content includes a navigation bar with links like "View the Form Instructions (PDF)". The main heading is "Data Provider Registration Form" with a note: "Mandatory fields have a red asterisk and must be fill in to receive Pin & Password via email".

The form is divided into three sections:

- Applicants Information:** Includes radio buttons for "Type of Requestor" (Consultant, Laboratory, Individual, Other). Mandatory fields (marked with red asterisks) are: Applicant First Name, Applicant Last Name, Applicant email, and Applicant Drivers License Number. A text field for "Reason for using website:" is also present.
- Company Information:** Includes fields for Company Name, Street, Box # or other, City, State, Zip[xxxxx], Phone[xxx-xxx-xxxx], Secondary Phone, Fax, Primary E-mail, and Secondary E-mail.
- Contact Person for Company:** Includes fields for Contact Person First Name, Contact Person Last Name, Street, Box # or other, and City.

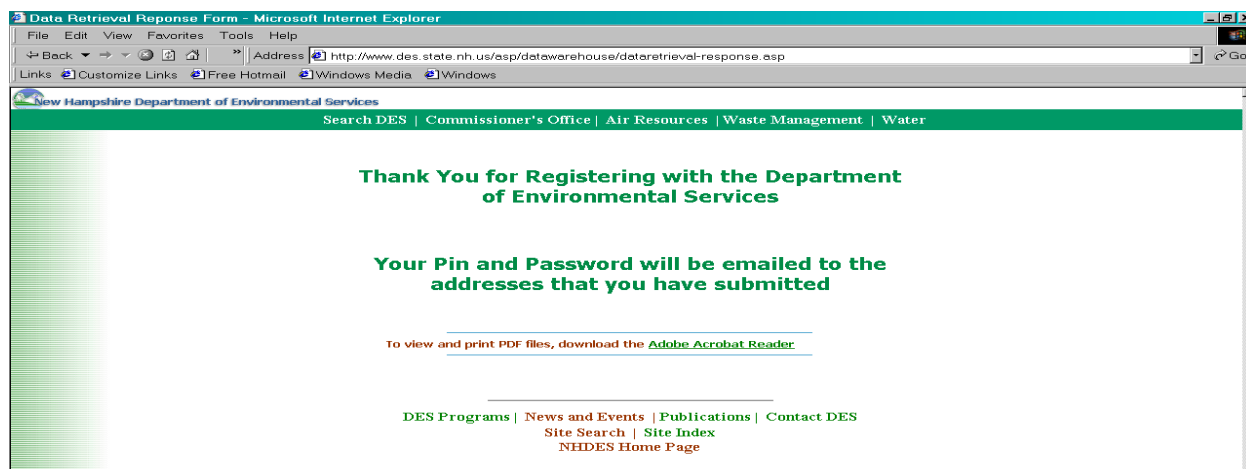
Data is validated upon the client pressing the submit button.

- Required fields are checked
- Telephone numbers must fit the displayed pattern
- Zip codes must fit the displayed pattern
- Emails must conform to set pattern

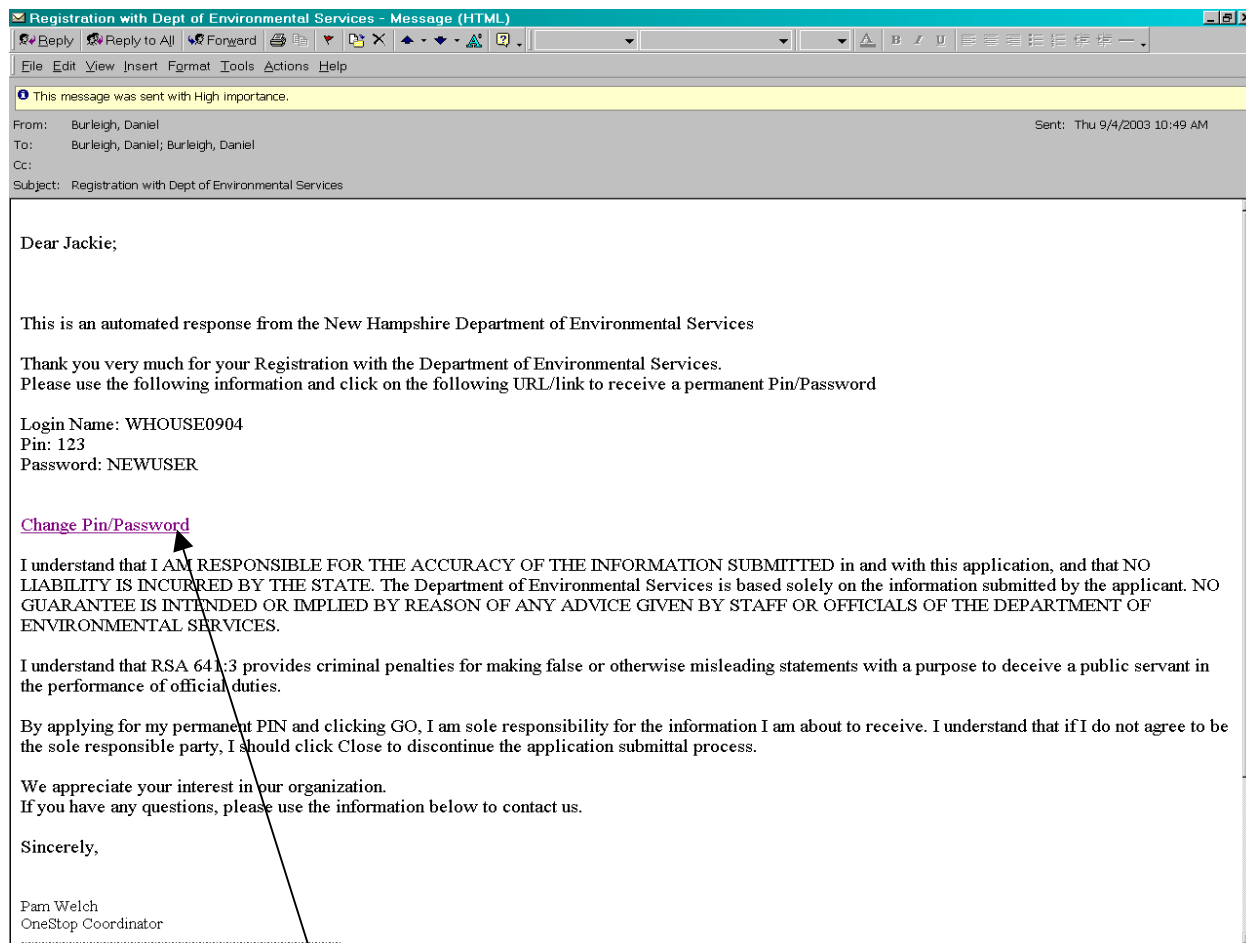
Once data passes this initial validation it will be stored in the DATAPROVIDER table for review by NH EPHT Program staff. They will physically be reviewing these applications and will check any inconsistencies. Staff will be able to perform this review and perform general account administration from an Oracle screen. Until this portion of the registration process is complete, clients will be unable to submit data.

The client is then moved to the following Internet page to confirm their registration application.

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Upon receipt of the registration application, the system will send an email to the Primary email address indicated on the registration form, which will include the Login Name, password, and PIN. The client receives the following email confirming that EPHI received the required information.



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The client clicks on this URL to change their password and receive their permanent PIN back in an email.

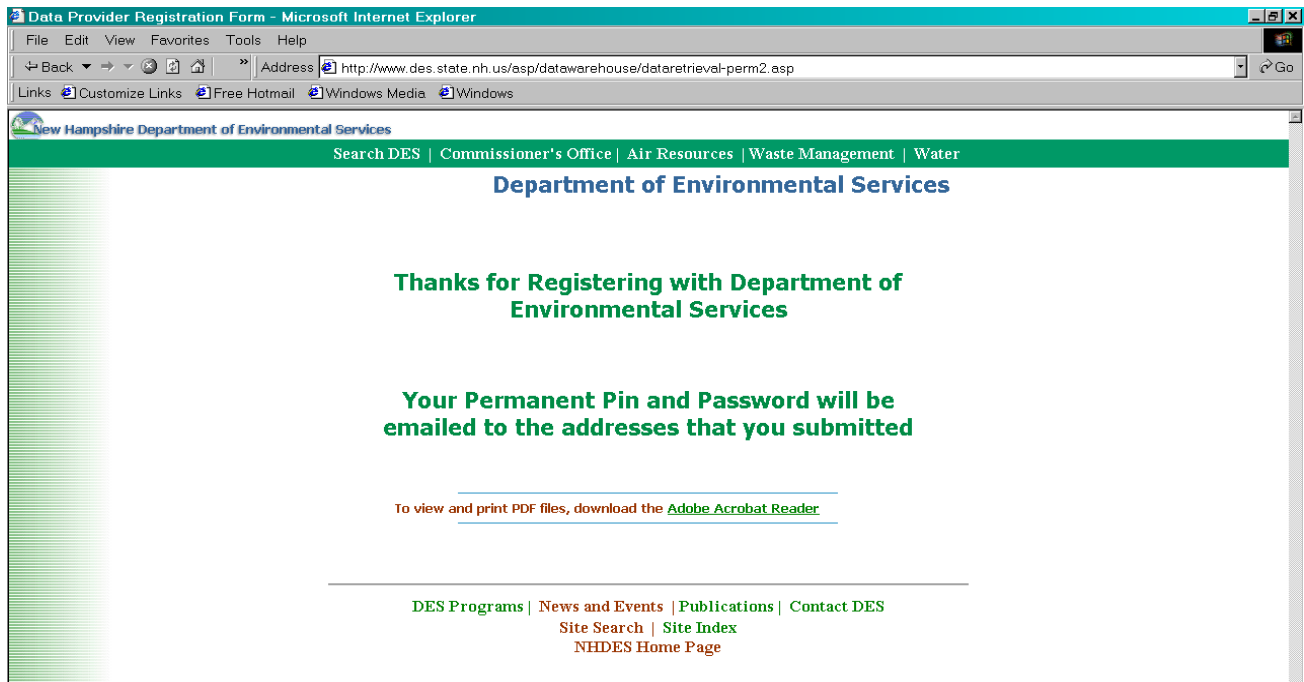
The Client clicks on the URL embedded within the Email that brings the client to a Web page to allow them to set their permanent password. The Client fills in the require information and submits.

- All fields are mandatory
- Upon submit, ASP does a Select from the registration table to verify the User record is stored in the table.
- Also the select criteria is based off the current screen parameters

The screenshot shows a web browser window titled "Data Provider Registration Form - Microsoft Internet Explorer". The address bar displays the URL "http://www.des.state.nh.us/asp/datawarehouse/dataprovider_perm.asp". The page header includes the "New Hampshire Department of Environmental Services" logo and a navigation menu with links: "Search DES", "Commissioner's Office", "Air Resources", "Waste Management", and "Water". Below the header, there is a link "View the Form Instructions (PDF)". The main heading is "Data Retrieval Registration Form" with a subtext "You must fill our mandatory fields to receive Pin & Password via email". The form section is titled "Applicants Information" and contains five input fields: "Login Name:" (filled with "CWELL DIGGERS0903"), "Pin:" (filled with "123"), "Old Password:" (filled with "*****"), "New Password:" (filled with "****"), and "Retype New Password:" (filled with "****"). A "Submit" button is located below the fields. At the bottom of the form, there is a link "To view and print PDF files, download the Adobe Acrobat Reader". The footer contains a horizontal line followed by links: "DES Programs", "News and Events", "Publications", "Contact DES", "Site Search", "Site Index", and "NHDES Home Page". The browser's status bar at the bottom shows "Internet".

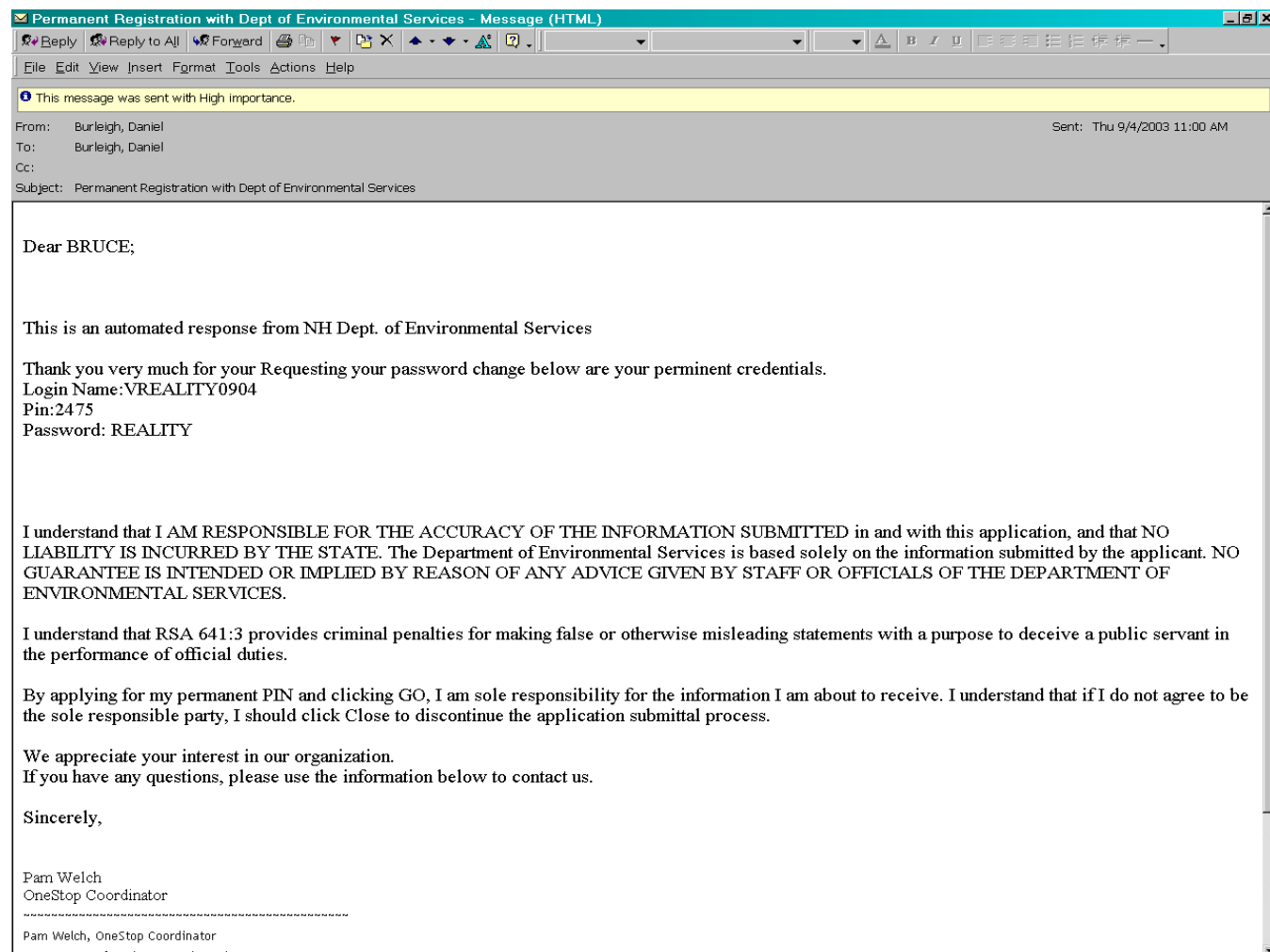
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Upon clicking the Submit button, the permanent password and PIN is set in the database. An email confirmation is also sent to the Primary email address of the client. The client is then shown a screen confirming that their Password and PIN have been changed.



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The Client receives the following email confirmation that the depicts that the require information was received.



The embedded PDF file will be specific to the EPHI process. This PDF will need to be printed and signed by the the data provider and will be returned via mail to the EPHI data steward. This additional step in conjunction with the other registration processes will satisfy the CROMERR rule as it is currently written.

Registration Process – Confirmation

After a client has filled out the online registration form and submitted the PDF file, DES staff will need to review the submitted PDF against the online application before the client can be accepted for electronic drinking water submissions. DES in-house staff will have access to the following screen. From this screen they will be able to administer all the needs of the Clients.

1. NH EPHT Approval will need to be entered as a YES
2. NH EPHT emails client back stateing approval has been granted

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3. NH EPHT puts in a brief comment rather there was an approval or denial and reason.
4. NH EPHT puts in a date on the process of the record.
5. NH EPHT puts in a date when the Trade Partner agreement is received.

Appendix B: Glossary of Terms

Term	Definition
Data Flow	A data flow is the Exchange Network term for any routine exchange of information between two or more network partners.
ebXML	Short for electronic business Extensible Markup Language, a modular suite of specifications for standardizing XML globally in order to facilitate trade between organizations regardless of size. The specification gives businesses a standard method to exchange XML-based business messages, conduct trading relationships, communicate data in common terms and define and register business processes.
Exchange Network	The Exchange Network is a secure Internet- and standards-based approach for exchanging environmental data and improving environmental decisions. The U.S. Environmental Protection Agency, State environmental departments, and U.S. tribes and territories are partnering to build the Exchange Network to increase access to environmental data and make the exchange of data more efficient. Using eCommerce technologies, data standards and agreed-upon templates for packaging data, Exchange Network participants control and manage their own data, while making it available to partners via requests over a secure Internet connection.
HTTP	Short for HyperText Transfer Protocol, the underlying protocol used by the World Wide Web. HTTP defines how messages are formatted and transmitted, and what actions Web servers and browsers should take in response to various commands.
NAAS	The Network Authentication Authorization Service (NAAS) is a set of security Web Services that the Central Data Exchange (CDX) centrally hosts and that is remotely administered by the State and EPA Node Network Administrators. The NAAS provides free security services for identity management, user authentication, user authorization, and access control policy management.
NEDSS	The National Electronic Disease Surveillance System (NEDSS) is an initiative that promotes the use of data and information system standards to advance the development of efficient, integrated, and interoperable surveillance systems at federal, state and local levels. It is a major component of the Public Health Information Network (PHIN).
PHIN	The Public Health Information Network (PHIN). A set of standards, architectures, and guidelines to enable the sharing of data and interaction and reuse of systems within the Public Health arena. PHIN is a collaborative effort of the Centers For Disease Control and Prevention (CDC) and state and local Public Health agencies, along with input from industry trading partners such as laboratories and hospitals.
Schema	Pronounce skee-ma, the structure of a database system, described in a formal language supported by the database management system (DBMS). In a relational database, the schema defines the tables, the fields in each table, and the relationships between fields and tables.

Term	Definition
SOAP	Short for Simple Object Access Protocol, a lightweight XML-based messaging protocol used to encode the information in Web service request and response messages before sending them over a network. SOAP messages are independent of any operating system or protocol and may be transported using a variety of Internet protocols
SSL	Short for Secure Sockets Layer, a protocol developed by Netscape for transmitting private documents via the Internet. SSL works by using a private key to encrypt data that's transferred over the SSL connection.
UDDI	Short for Universal Description, Discovery and Integration. A Web-based distributed directory that enables businesses to list themselves on the Internet and discover each other, similar to a traditional phone book's yellow and white pages.
Web Service	The term Web Services describes a standardized way of integrating Web-based applications using the XML, SOAP, WSDL and UDDI open standards over an Internet protocol backbone. XML is used to tag the data, SOAP is used to transfer the data, WSDL is used for describing the services available and UDDI is used for listing what services are available. Used primarily as a means for businesses to communicate with each other and with clients, Web Services allow organizations to communicate data without intimate knowledge of each other's IT systems behind the fire-wall.
W3C	Short for World Wide Web Consortium, an international consortium of companies involved with the Internet and the Web. The organization's purpose is to develop open standards so that the Web evolves in a single direction rather than being splintered among competing factions.
WSDL	Short for Web Services Description Language, an XML-formatted language used to describe a Web service's capabilities as collections of communication endpoints capable of exchanging messages. WSDL is an integral part of UDDI, an XML-based worldwide business registry. WSDL is the language that UDDI uses.
XML	Short for Extensible Markup Language, a specification developed by the W3C. XML is a pared-down version of SGML, designed especially for Web documents. It allows designers to create their own customized tags, enabling the definition, transmission, validation, and interpretation of data between applications and between organizations.
XSD (XML Schema)	Short for XML Schema Definition, a way to describe and validate data in an XML environment. (A schema is a model for describing the structure of information.) XSD is a recommendation of the W3C.

Sources:

CDC: <http://www.cdc.gov/nedss> and <http://www.cdc.gov/phinf/>

EPA Exchange Network: <http://www.exchangenetwork.net/>

Webopedia: <http://www.webopedia.com/>